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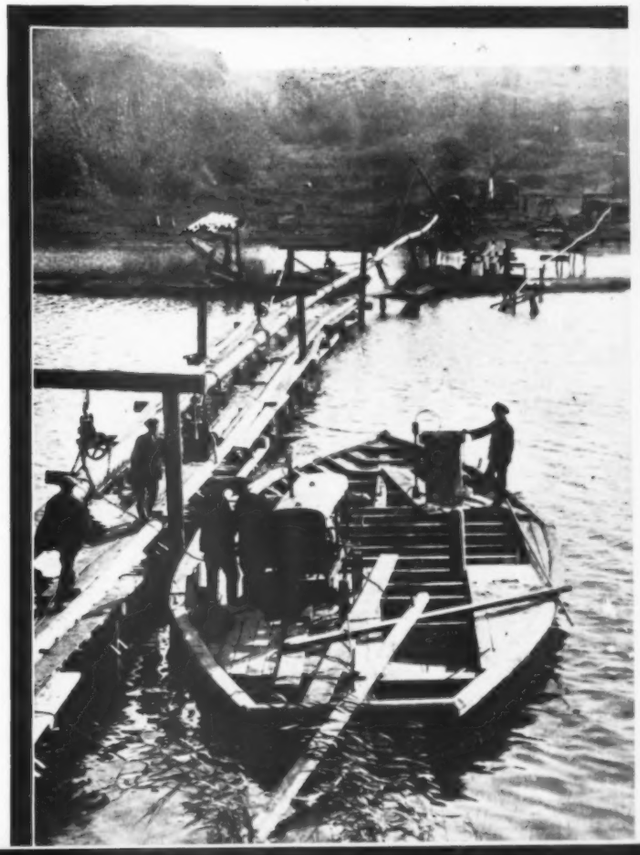
WORLD PETROLEUM

World Crude Oil Production Since 1857 by Countries and Geologic Divisions and World Figures for 1935 • French Price War May Be Settled by Agreement • Prospect for Italian Petroleum Embargo by U. S. Recedes • Improvement in British Market Noted in '35



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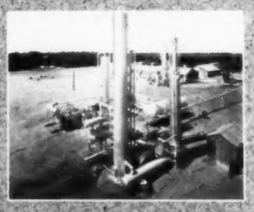

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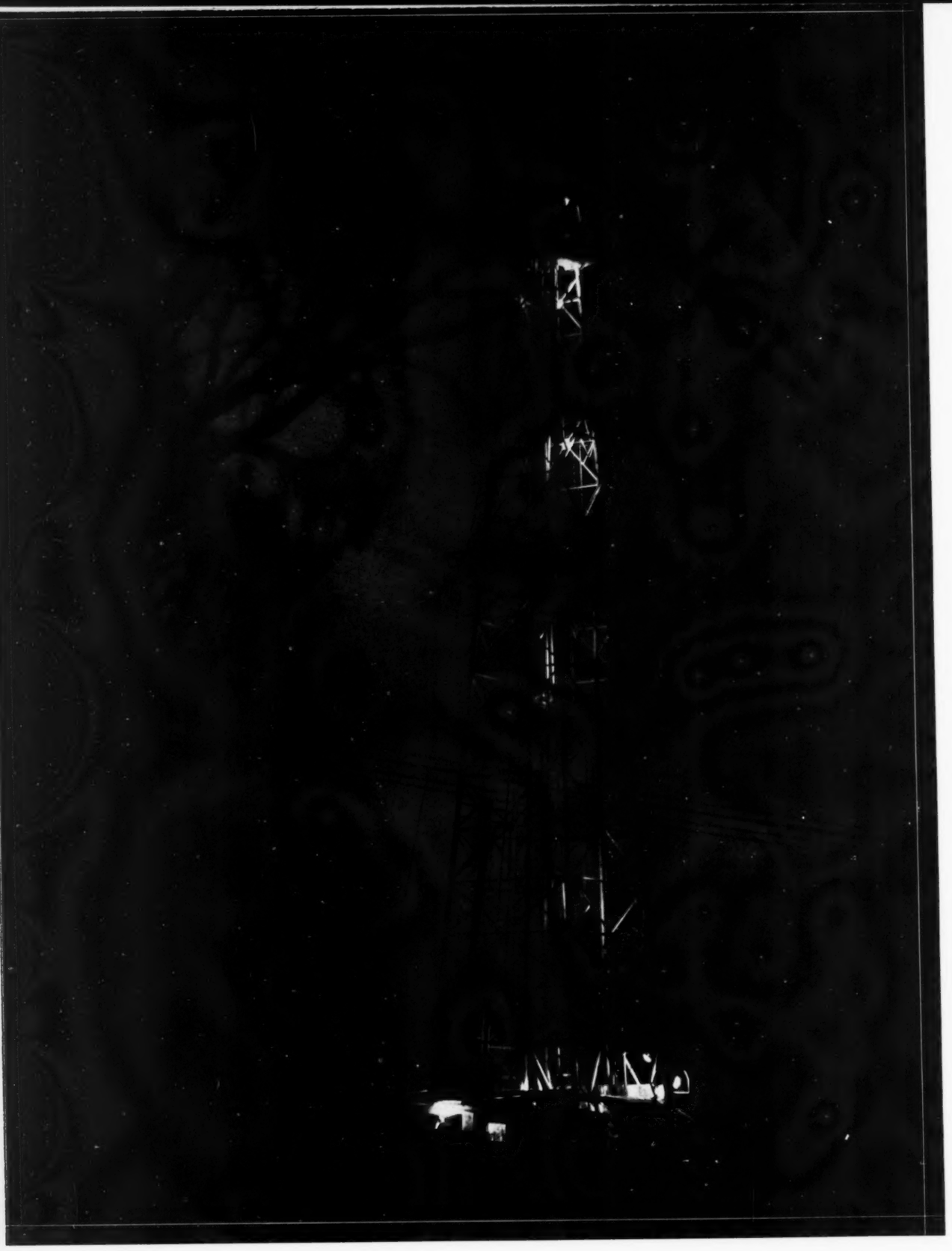


NEW YORK • # WORLD PETROLEUM • LONDON

CITIZENS of the United States who attempt to understand and appreciate factors that affect the shifting picture of European economy and diplomacy are conscious of a growing sense of relief as the prospect of an American embargo on oil shipments to Italy grows dim. Obviously Italy would be far more sensitive to action of this sort in the United States, which is not bound to support League action, than she would be in the case of a League nation. An American embargo on oil shipments would come as a gratuitous affront to what is formally and in fact a friendly nation. The blow would hardly be lightened by applying the embargo to "shipments to belligerents" in view of the fact that an embargo might have very serious results in Italy while it could not, of course, have a very marked effect in Ethiopia.

A Sigh of Relief

While the effort to maintain neutrality in the United States is a most laudable one, it is questionable if the best means to accomplish this aim is to go out of one's way to affront a nation whose destiny, at least in her own opinion, calls her to a leading position among world powers.

Whatever the individual's opinion as to the rights and wrongs involved in the Ethiopian campaign, it must be remembered that as a nation the United States has not formally decided which country is responsible for the conflict. The United States should not, therefore, take any steps that would penalize one country, assist another, nor in any way affect the outcome of the war, no matter how such a step might be phrased as applying equally to both countries, when actually it is obvious to everyone that interference with the oil trade would be aimed directly at Italy.

▼

IT IS important to distinguish between the conditions under which the League and the United States would be working in deciding upon restraining oil shipments to Italy and Ethiopia. Formally the United States has reached no decision as to the responsibility for the conflict (as the League has done), nor has she any right to interfere with another sovereign and friendly power, whatever the private opinion of U. S. citizens as to her conduct. The League, on the other hand, has every right to interfere, having been established for that very purpose; a purpose to which both Italy and Ethiopia have subscribed and, in the past, have supported.

A Dangerous Instrument

But even the League appears to feel that oil sanctions constitute a weapon too dangerous to handle. The time when oil sanctions might have been most effective has been allowed to pass and the issue in Ethiopia seems likely to be decided as a result of the race between the Italian forces and the approaching rainy season, with the Ethiopian armies occupying a minor role.

▼

PRELIMINARY crude oil production figures for the world, covering 1935, are now available. They indicate an important increase in world production. Led principally by an increase of some 80,000,000 bbl. in U. S. output and followed by important increases in Venezuela and Russia, almost every country contributed to the larger world total. It is a measure of the extent to which the world oil picture has changed to consider the complacency with which this considerable increase is viewed by the industry. Demand has improved so phenomenally that overproduction is no longer a major factor; if any anxiety is felt within the industry, it is much more likely to be over the question of developing reserves with sufficient speed to keep pace with the rapidly increasing demand.

Untimely Proposals

South American production may soon be a matter of vital importance to the United States, especially in consideration of the rapidity with which the latter is producing crude in relation to her total available supply. And yet, just at this turning point in the affairs of the American industry, the Administration is lending ear to proposals for an increased oil tariff, a proposition which, if it ever had any validity, certainly has lost all claim to it in 1936.

Despite changing conditions, certain elements within the industry wish to produce U. S. crude with all possible haste in order to create a future crisis of conditions that could easily be met and tempered by a gradual transition. The dominant position of the American industry can best be maintained by supplementing limited domestic supplies with imports, rather than rigidly excluding all outside sources while feverishly exhausting domestic reserves.

25,696,600,000 Bbl. Produced to End of '34

Location and Production of Leading World Pools — Over One-Third Total World Production to End of '34 Was Paleozoic, Nearly One-Half Tertiary in Origin.

By D. Jerome Fisher

Assoc. Prof. of Geology
Univ. of Chicago

BARRING those rare deposits where resins have accumulated in sufficient quantities to constitute the major portion of a rock mass, there are but two known kinds of ancient natural accumulations that are composed dominantly of combustible organic matter—petroleums and coals. The latter, depending on their grades, are more or less pure masses of organic matter—from the geologist's point of view, the only known rocks consisting essentially of fossil organisms lacking "hard" parts. While it is not known just when these were converted to coal, it is known in the great majority of cases just when the organism existed, the "just when" being used in a geologic sense.

Not so with petroleum. Unlike coal, the graves in which was buried the non-terrestrial organic matter later converted to oil were robbed. And yet the petroleum geologists (the anthropologists of oil) are never absolutely certain that they have found the old graveyard! In this sense their task is more intricate than that of the Egyptologist, in spite of the aphorism that social sciences are far more difficult to handle than the ordinary biophysical ones.

Because of this migratory nature of petroleum, most geologists do not date an oil from the time the raw materials were deposited, as is commonly done with coal and other rocks, but from the age of the strata where accumulation has occurred. It is obvious that a given petroleum pool is never older and may be much younger than its reservoir rocks, but it seems reasonably certain that in some cases the source materials were laid down many millions of years before the deposition of the reservoir rock. In the later discussion, the age of a petroleum refers to the age of its enclosing rocks.

The accompanying charts show the approximate location of the leading producing areas of 17 countries; the United States is split into five provinces numbered 7 to 11 inclusive; thus the world contains 21 subdivisions, each of which (except Iraq and Sakhalin) has produced over 50,000,000 bbl. of petroleum. These are numbered in order beginning with the southern end of the Western Hemisphere and proceeding north, followed by the Eastern Hemisphere going from northwest to southeast, except that Sakhalin is next to the U.S.S.R. for obvious reasons, and similarly Japan is placed by Sakhalin. The latter, though it has produced less than Canada, Germany or Egypt (none of which is indicated on the chart), is included because of its political and producing affiliations. Iraq is shown because its 1934 production and its future potential definitely warrant this.

The chart depicts in order from 1 (at the base) to 21 the volume of annual production of each subdivision from the time of first production to the end of 1934. The five subdivisions of the United States are so listed that Paleozoic oils appear below Cretaceous oils which are below Tertiary oils, the natural order of supposition. The chart is colored to show the geologic ages of the reservoir rocks. These are correct within surprisingly close limits, considering the areas involved, as is brought out in detail later. Table 1 gives 1934 and total production figures for the units shown on the chart, as well as for other countries, and also shows the totals for the three ages considered; these totals are not exact; the matter is further discussed below.

With the exception of the United States, the total production of any country can be assumed to be one of the three geologic ages under consideration. On a percentage basis there will be but minor errors except in the case of Germany. It is therefore not difficult to summarize statistics for these as given in Table 1.

In the case of the United States, however, it is necessary to split the country into five provinces—one of which, the Gulf Coastal Plain, is duplex in nature—in order to have production according to geologic age. This gives a fairly clean cut age separation except for the Rocky Mounatin province, and in particular its northern portion. For Wyoming less than five percent of the production has come from the Paleozoic, but over 65 percent of the Montana production has been derived from this sequence. This is to be expected when it is recalled that 85 percent of the contiguous Alberta production, which geographically belongs with the Rocky Mountain province, has been recovered from the Paleozoic.

To obtain the data for some of the areas of the United States as shown in Table 1, it was necessary to subdivide the figures as commonly summarized. This required a tedious checking through MINERAL RESOURCES OF THE UNITED STATES. Those not interested in such details may skip the paragraphs in smaller type.

The Appalachian Region as here used is the same as that given in MINERAL RESOURCES; i.e., includes Eastern Ohio and all of Kentucky and Tennessee. (It would seem better to lump Western Kentucky and adjacent Tennessee with the Illinois-S. W. Indiana Region, thus limiting Appalachian Region to that east of the Cincinnati Arch-Cumberland Saddle-Nashville Dome.) The other three regions of the Eastern Province are lumped in Table 1. Broken down the figures are:

Region	Production—millions of bbl. 1934 only	To end 1934
Lima-Indiana	1.000	477.951
Michigan	10.603	38.814
Illinois-S. W. Indiana	5.293	429.256
Totals	16.896	946.021

The Mid-Continent Province as shown on the map is limited to Paleozoic oils, except for the minor Comanchean (Trinity) production of Marshall County, Oklahoma, which probably originated in Paleozoic strata. It thus includes the five units listed in Table 1. North-central Texas as here used is the same as North Texas of MINERAL RESOURCES OF THE UNITED STATES and of North Texas and North Central Texas of the A. I. M. E. The only figures that require further breaking down are:

Area	Production—millions of bbl. 1934 only	To end 1934
Osage-Burbank	14.872	465.
Greater Seminole	38.183	667.670
Oklahoma City	62.829	250.548
West Texas	50.272	690.690
S. E. New Mexico	16.488	70.658

Regarding the figures for the Rocky Mountain Province, it is perhaps worth noting that for the first five years (1925–1929) of production from S. E. New Mexico (total 4,088,000 bbl.), this was included with Rocky Mountain production in MINERAL RESOURCES OF THE UNITED STATES. But with the large increase in 1930, production from this area was lumped with West Texas, as is all S. E. New Mexico production in this

paper. Wyoming and Montana production figures appear in Table 2.

The Inner Gulf Coastal Plain of Table 1 includes the following:

Area	Production—millions of bbl. 1934 only	To end 1934
Central Texas[1]	12.610	414.221
Northeast Texas — East Texas proper	181.540	617.504
Northeast Texas — Van, Boggy Creek, etc.	14.960	84.256
Northern Louisiana	9.075	377.563
Arkansas	11.182	407.983
Totals	229.367	1,901.527

[1] Terminology of the A. I. M. E., which is approximately that of the U. S. Bureau of Mines; includes the pools along the arc from Navarro Co. to Maverick Co.

The Outer Gulf Coastal Plain may be broken down into:

Area	Production—millions of bbl. 1934 only	To end 1934
Texas Gulf Coast	60.155	899.819
Southwest Texas[2]	10.123	55.255[1]
Louisiana Gulf Coast	23.794	168.261
Totals	94.072	1,123.335
Conroe (in Texas Gulf Coast above)	17.138	40.983

[1] Including 0.422 from Calliham during 1924–1930.

[2] Terminology of the A. I. M. E.; includes 13 counties in S. W. Texas. Mineral Resources of the United States has at times (1930) had McMullen Co. (Calliham) in its Central Texas, but placed it with S. W. Texas in 1931, when it also included Live Oak Co. in its S. W. Texas, here put with the Gulf Coast. Similarly Jim Wells Co., put with S. W. Texas in Minerals Yearbook, 1934 (Statistical Appendix, p. 225), is here put with the Gulf Coast.

California production figures are published in terms of five districts. The San Joaquin District of Table 1 includes Districts 4 and 5 of the California State Mining Bureau. The Los Angeles District corresponds to District 1, less those pools north of the Santa Monica Mountains (Newhall; or Elsmere, Wiley Canyon, and Pico Canyon), which are grouped with the Ventura-Santa Barbara District, which also includes all of District 2 and that part of District 3 south of the Santa Ynez Mountains (Summerland, Mesa, Elwood and La Goleta, and Capitan pools). Santa Maria and Santa Clara (really two districts) are lumped; they include the remainder of District 3. The districts as listed in Table 1 are outlined on maps by E. H. McCollough.* Figures for individual pools shown on the chart are as follows:

Area	Production—millions of bbl. 1934 only	To end 1934
Long Beach	22.788	523.550
Santa Fe Springs	14.663	388.631
Kettleman Hills	21.390	90.879
Midway-Sunset	19.723	789.674

It will be noted that the Midway-Sunset area has produced more than any other in the United States to date, though the East Texas pool bids fair to surpass this early in 1936. Certainly the East Texas pool is the largest single oil pool, meaning by this that it had the most oil in one continuous area in a single reservoir horizon. All California production is from Tertiary strata, except part of the West Coalinga oil from the Upper Cretaceous.

* Problems in Petroleum Geology, Amer. Assn. Petr. Geol., 1934, 740–757.

The details as regards certain age corrections of the data given in Table 1 are shown in Table 2. These, especially as applied to certain production figures applying to regions outside the United States, may have errors of probably minor importance, as is discussed below.

All U.S.S.R. production except that from the Emba area (Jurassic) is presumed to be Tertiary. Other non-Tertiary production is known (e.g., some of the Ferghana oil is Cretaceous), but is of little importance on a percentage basis. All of the Polish petroleum except that from Schodnica-Urycz and Weglowka is taken as Tertiary, though a minor part of this is Cretaceous. The chart indicates that Polish production dates back to 1874, though, of course, mod-

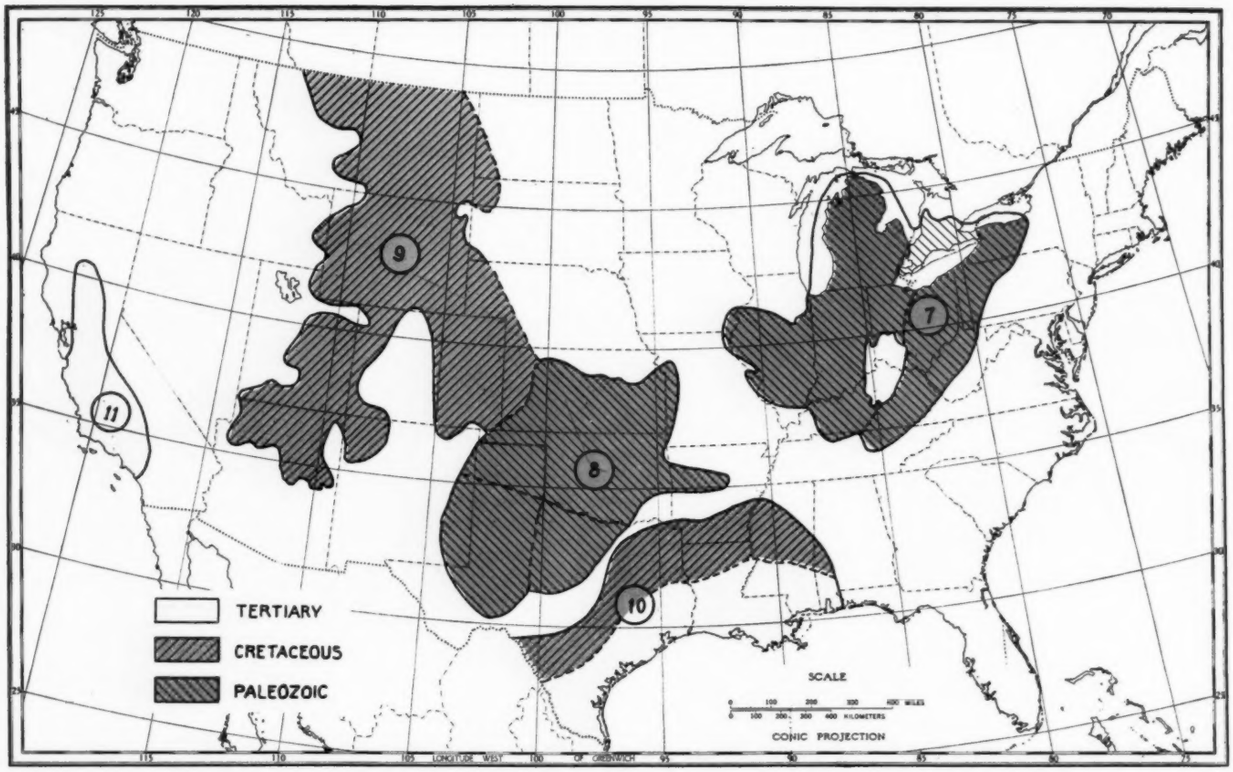
Table 1

Petroleum Production

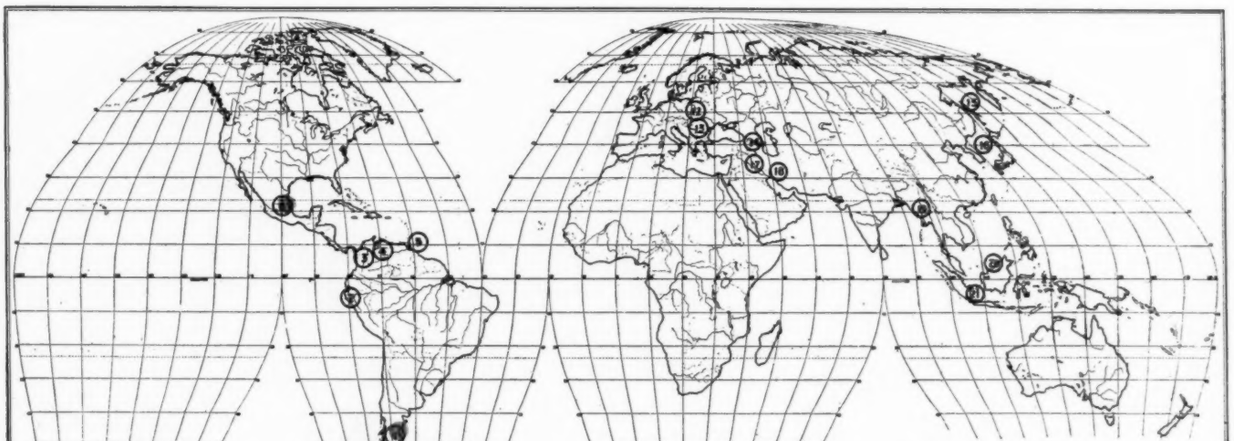
(millions of bbl.)

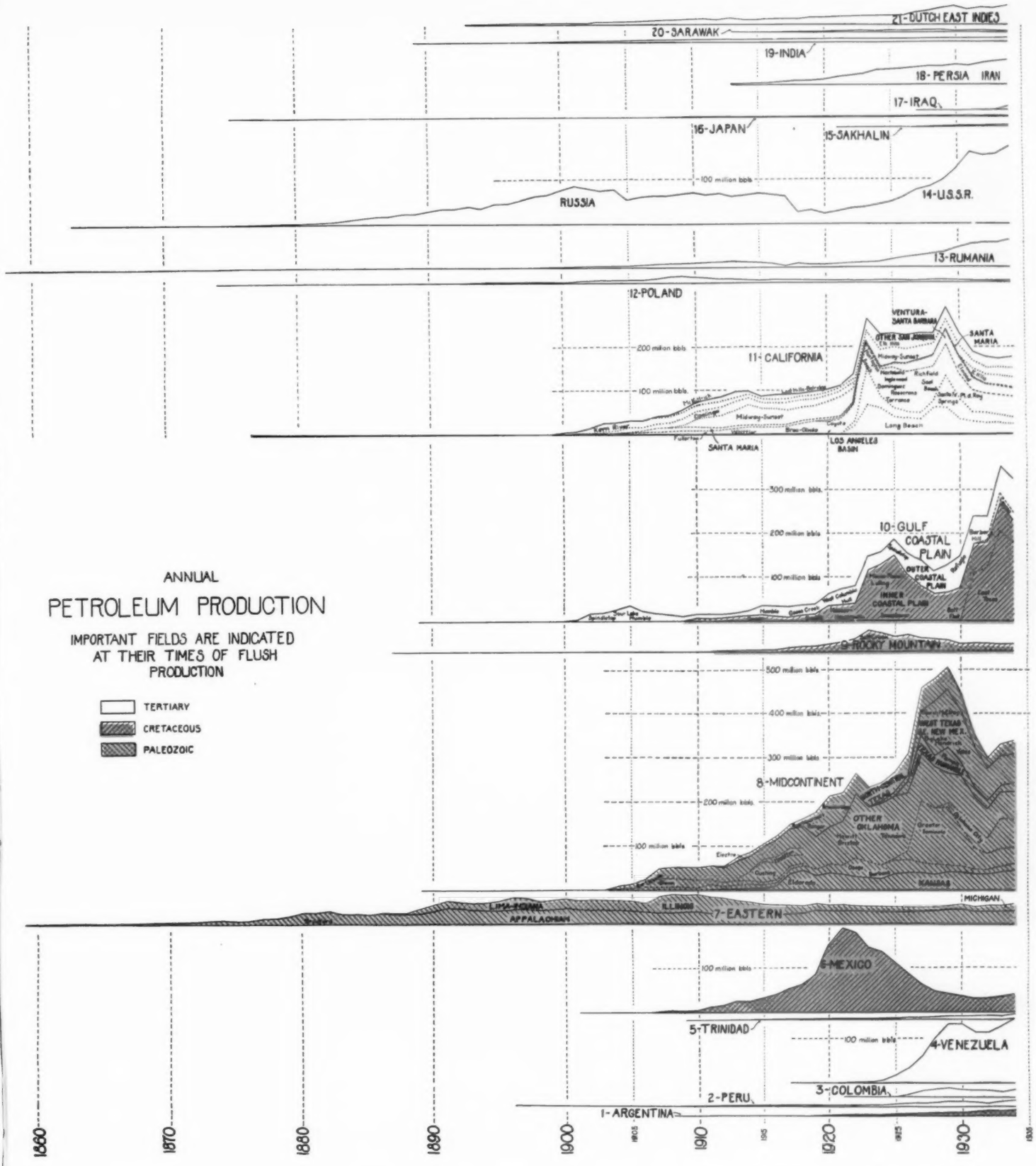
Approximately According to Geologic Ages of Reservoir Rocks

	Tertiary	1934	To end 1934
21.	Netherland India	43.7	638.1
20.	Sarawak and Brunei	2.2	60.4
19.	British India	9.2	244.7
18.	Iran (Persia)	35.9	593.7
17.	Iraq	7.7	13.4
16.	Japan	1.4	67.4
15.	Sakhalin	3.3	15.8
14.	U.S.S.R.	176.1	3,204.6
13.	Roumania	61.8	602.0
12.	Poland	3.9	239.9
11. Calif.	San Joaquin	69.7	1,791.4
11. Calif.	S. Maria and S. Clara	1.8	129.0
11. Calif.	Ventura-S. Barbara	16.9	263.4
11. Calif.	Los Angeles	85.9	2,027.2
10b.	Outer Gulf Coastal Plain	94.1	1,123.4
5.	Trinidad	11.0	104.3
4.	Venezuela	145.8	1,014.5
3.	Colombia	17.8	150.0
2.	Peru	13.8	167.9
	Rest[1]	2.7	24.6
	Total	824.7	12,475.7
	Cretaceous		
10a.	Inner Gulf Coastal Plain	229.4	1,901.5
9.	Rocky Mountains[2]	17.7	472.6
6.	Mexico	41.7	1,741.0
1.	Argentina	13.9	123.1
	Rest[3]	3.8	56.5
	Total	306.5	4,294.7
	Paleozoic		
8.	North-central Texas	31.5	803.2
8.	W. Texas-S. E. New Mexico	66.8	761.4
8.	Texas Panhandle	20.3	232.0
8.	Oklahoma	180.1	3,694.4
8.	Kansas	46.5	750.1
7.	Illinois-Indiana-N. W. Ohio-Michigan	16.9	946.0
7.	Appalachian	30.5	1,702.9
	Rest[4]	1.5	35.4
	Total	394.1	8,925.4
Miscellaneous			0.8
	Grand Total	1,525.3	25,696.6
1	Ecuador	1.8	12.3
1	France	0.6	8.2
1	Italy	0.15	2.2
1	Czechoslovakia	0.1	1.7
1	Algeria		0.2
2	Includes Alaska and some miscellaneous U. S. production		
3	Egypt	1.5	28.2
3	Germany	2.3	28.3
4	Canada	1.3	35.0
4	Bolivia	0.15	0.4



Location of areas of world which from 1857 to end of 1934 have produced over 50,000,000 bbl. of petroleum. The colors indicate the geologic age of the formations from which the oil was produced.




ANNUAL
PETROLEUM PRODUCTION
IMPORTANT FIELDS ARE INDICATED AT THEIR TIMES OF FLUSH PRODUCTION
TERTIARY
CRETACEOUS
PALEOZOIC
21-DUTCH EAST INDIES
20-SARAWAK
19-INDIA
18-PERSIA IRAN
17-IRAQ
16-JAPAN
15-SAKHALIN
14-U.S.S.R.
RUSSIA
13-RUMANIA
12-POLAND
11-CALIFORNIA
VENTURA-SANTA BARBARA
SANTA MARIA
LOS ANGELES BASIN
10-GULF COASTAL PLAIN
OUTER COASTAL PLAIN
INNER COASTAL PLAIN
9-ROCKY MOUNTAIN
8-MIDCONTINENT
OTHER OKLAHOMA
KANSAS
MICHIGAN
7-EASTERN
APPALACHIAN
6-MEXICO
5-TRINIDAD
4-VENEZUELA
3-COLOMBIA
2-PERU
1-ARGENTINA
100 million bbls
200 million bbls
300 million bbls
400 million bbls
500 million bbls
1860
1870
1880
1890
1900
1905
1910
1915
1920
1925
1930
1935

ern Poland as a state came into being under the Versailles Treaty; strictly speaking earlier production should be credited to Hungary, but is not since geographic location is regarded as of greater importance than political control in this connection. However it should be noted that only the Alsatian (Pechelbronn) production since 1917 is credited to France in Tables 1 and 2. The Gabian pool produces from Triassic rocks.

The Mexican production is assumed as Cretaceous, except that from the Isthmus of Tehuantepec which is taken to be Tertiary. This is only a rough separation on an age basis, but no known better one is available. Most Argentine production is Cretaceous (Commodoro Rivadavia), but mid-Jurassic production is found in Neuquen, and Permocarboniferous at Salta near the Bolivian border. All Egyptian production except that from Gemsa (Tertiary) is alloted to the Cretaceous.

German production was split, as given in Table 2, only with some difficulty; the results shown are approximations at best. Use was made of production tables prepared by W. Kauenhowen.* All the Paleozoic oil came from Volkenroda. Mesozoic production to the end of 1934 was assumed to be as follows:

Area	Production—millions of bbl. Total	Cretaceous	Jura-Trias
Nienhagen	7.00	6.05?	0.95?
Oberg	0.72	—	0.72
Oelheim	1.06	0.33	0.73
Wietze	13.02	5.12	7.90
Totals	21.80	11.50	10.30

The Tertiary production shown under Germany in Table 2 is that from Pechelbronn prior to 1918.

The revised summaries as given in Table 3 are obtained by applying the corrections listed in Table 2 to the figures given in Table 1. It is clear that but an insignificant amount of oil comes from the Jura-Trias if the figures are put in terms of percentages of totals. In the most extreme case, that of 1934 production from the world, excluding the United States, only 6.8 percent of the petroleum production listed under Cretaceous is really from Jura-Trias strata, and this constitutes but 0.55 of one percent of the total 1934 production outside of the United States. This 0.55 percent is from the U.S.S.R., Argentina, and Germany.

Table 3 shows that roughly 49 percent of the world's production has come from the Tertiary, 35 percent from the Paleozoic, and 16 percent from the Cretaceous. But 99.54 percent of the Paleozoic oil has come from the United States. Most of the remainder has come from Canada. Bolivia (and to a much lesser extent adjacent Argentina and Peru) will presumably be an important Paleozoic producer, as may Russia. Germany may also figure in this connection, though Volkenroda has declined very rapidly in recent years. The United States has supplied over 40 percent of the total Tertiary oil and nearly 55 percent of the total Cretaceous oil produced to the end of 1934. Over 40 percent of the total Cretaceous oil has come from Mexico.

Contrasting 1934 figures with those showing total to the end of 1934 emphasizes the importance of the East Texas pool. Even without the hot oil from East Texas (not included in the figures) it is clear that the proportion of Cretaceous oil being produced in the United States now, as compared to that produced by the rest of the world, is much greater than it has been during the past. This is what has kept the United States in its dominant position since 1930. These and other data are brought out in Table 4, which was prepared from the figures of Table 3, and so contains the same errors, in that part of the oil listed under Cretaceous is really of Jura-Trias age.

Even as more of the world crude oil production is of Tertiary age than of any other age, so it is true that the richest pools (greatest per-acre production) are of Tertiary age. Such pools as Baku, Long Beach, Santa Fe Springs, Lagunillas, Spindletop, and West Columbia each shows over 250,000 bbl. of oil per acre already produced. It may be that certain pools on the Golden Lane also belong in this category, but no figures have come to the writer's attention. The richest Paleozoic pools—Oklahoma City, Tonkawa, Big Lake—have not yet reached 50,000 bbl. per acre. These figures are all based on actual production to the end of 1934, not potential. Otherwise Kettleman Hills and others would not be omitted. If the richest pool be defined as the one with the greatest average per acre-foot production, it is possible that some Paleozoic pool would take the prize, as most Tertiary pools have notoriously thick producing horizons.*

The chart, in addition to bringing out graphically most of the material of Table 1, also gives a good view of the relative importance, at different times and places, of the different ages of petroleum production. Visualized in terms of the skin (crust) of the earth, it supplies a concise picture of the volume of oil produced

* Data for such computations are in part available in Vol. 114 of the Transactions of the American Institute of Mining and Metallurgical Engineers; here Jennings, La. is given as 3,933 bbl. per acre/foot and Braman, Okla. is next with 1,375, but data are lacking for many pools, especially those outside the United States.

* Bull. Amer. Assn. Petr. Geol., *12*, 476–479, 1928.

Table 2

Corrections as Regards Ages of Petroleum Reservoirs

To end 1934 in millions of barrels

		Total	Tertiary	Cretaceous	Jura-Trias	Paleozoic
U.S.S.R.		3,204.6	3,183.2	...	21.4	...
Poland		239.9	219.1	20.8	...	...
Peru		167.9	167.6	...	0.3	...
France		8.2	8.05	...	0.15	...
Total non-Tertiary		42.65	...	20.8	21.85	...
Inner Plain (Urania, etc.)		1,901.5	19.2	1,882.3	...	...
* Rky Mt.	Montana	49.6	...	15.25	2.0	32.35
	Wyoming	387.29	3.85	356.66	8.3	18.48
	Utah	0.16	...	...	0.15	0.01
Mexico		1,741.0	59.5	1,681.5	...	...
Argentina		123.1	0.2	106.6	10.1	6.2
Egypt		28.2	1.3	26.9	...	...
Germany		28.3	6.0	11.5	10.3	0.5
Total non-Cretaceous		178.44	90.05	...	30.85	57.54
Canada		35.0	...	0.5	0.2	34.3
Total non-Paleozoic		0.7	...	0.5	0.2	...

1934 only, in millions of barrels

		Total	Tertiary	Cretaceous	Jura-Trias	Paleozoic
U.S.S.R.		176.1	174.4	...	1.7	...
Poland		3.9	3.5	0.4	...	...
Peru		13.8	13.8	...	...	...
France		0.6	0.6	...	...	...
Total non-Tertiary		2.1	...	0.4	1.7	...
Inner Plain		229.4	1.2	228.2	...	...
* Rky Mt.	Montana	3.6	...	0.5	1.1	2.0
	Wyoming	12.6	0.4	8.7	0.9	2.6
	Utah	...	...	...	...	...
Mexico		41.7	9.6	32.1	...	...
Argentina		13.9	...	10.8	1.1	2.0
Egypt		1.5	...	1.5	...	...
Germany		2.3	...	1.7	0.6	...
Total non-Cretaceous		21.5	11.2	...	3.7	6.6
Canada		1.3	...	.05	...	1.25
Total non-Paleozoic		.05	...	.05	...	...

* Oil production from N. W. New Mexico and from Colorado is all Cretaceous, except for minor Jurassic production from the latter at Iles and Hamilton, and a negligible quantity of Wasatch oil at Hiawatha.

Table 3

Petroleum Production by Geologic Ages of Reservoir Rocks

	Tertiary	Cretaceous * and Paleozoic	Cretaceous *	Paleozoic	Total
UNITED STATES					
To end 1934					
Millions of Barrels	5,357.45	11,241.05 [1]	2,300.21 [1]	8,940.84	16,598.5
Percent	32.3	67.7	13.9	53.8	100
1934 only					
Millions of Barrels	270.0	638.1 [2]	240.9 [2]	397.2	908.1
Percent	29.8	70.2	26.6	43.6	100
REST OF WORLD					
To end 1934					
Millions of Barrels	7,165.65	1,931.65 [3]	1,890.25 [3]	41.4	9,097.3
Percent	78.8	21.2	20.8	0.4	100
1934 only					
Millions of Barrels	563.8	53.4 [4]	49.95 [4]	3.45	617.2
Percent	91.3	8.7	8.1	0.6	100
TOTAL					
To end 1934					
Millions of Barrels	12,523.1	13,172.7 [5]	4,190.46 [5]	8,982.24	25,695.8
Percent	48.8	51.2	16.3	34.9	100
1934 only					
Millions of Barrels	833.8	691.5 [6]	290.85 [6]	400.65	1,525.3
Percent	54.7	45.3	19.0	26.3	100

* Includes Jura-Trias as follows: [1] 10.45; [2] 2.0; [3] 42.45; [4] 3.4; [5] 52.9; [6] 5.4.

from given areas at various stratigraphic depths. This gives the time-length-breadth picture, but data to give a rough conception of actual depth of reservoir are not incorporated (it is doubtful if they could be in any worthwhile manner). Moreover, the dates of first production in the various areas are clearly indicated. By means of written-in names, a fair picture is given of the dates of flush production of some of the leading pools of the United States. Some appear twice; e.g., Spindletop. Perhaps by contrast the outstanding feature of the chart is the remarkable uniformity over such a long period of years of the graph for the Appalachian Region, which contains the only big pool * (Bradford) east of the Mississippi.

Table 4

Percentage of World Petroleum Production from the United States

	Tertiary	Cretaceous and Paleozoic	Cretaceous	Paleozoic	Total
To end 1934	42.75	85.45	54.9	99.54	64.55
1934 only	32.4	92.4	80.75	97.75	59.6

Acknowledgements: Most of the figures given are derived from MINERAL RESOURCES OF THE UNITED STATES, of the U. S. Bureau of Mines (U. S. Geological Survey prior to 1924), since 1931 known as the MINERALS YEARBOOK (with Statistical Appendix). For sources from which to prepare the data given in Table 2, the writer is under especial obligation to the TRANSACTIONS OF THE PETROLEUM DIVISION OF THE AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, and particularly to the volumes published since 1933 in which the uniform manner of showing production statistics was inaugurated under the direction of Frank A. Herald. The 1934 figures for production outside the United States are taken in part from the BULLETIN OF THE INSTITUTION OF PETROLEUM TECHNOLOGISTS. Certain recent figures were very kindly supplied by the Chief Economist of the U. S. Bureau of Mines and by the California State Oil and Gas Supervisor. Mr. Edward L. Tullis helped with the drafting.

* McIntyre, James: Forty-eight Fields Yield 57 percent of Country's All Time Oil Production. Oil and Gas Journal, Oct. 31, 1935, p. 12.

▼

Socony-Vacuum Personnel Changes

MR. ARTHUR T. ROBERTS has been elected treasurer of the Socony-Vacuum Oil Company, Inc., succeeding Mr. F. S. Fales, vice-president, director and member of the executive committee.

Mr. Roberts has served for sixteen years as assistant treasurer and has been in the service of the company for 29 years. Starting as junior clerk in 1907, he came through the ranks and has occupied many positions of importance before coming to his present work.

Mr. Fales, Mr. Roberts' predecessor, has been identified with the company for over 32 years, and has been treasurer since 1934. He joined the Standard Oil Company in 1903 as assistant manager

Arthur T. Roberts

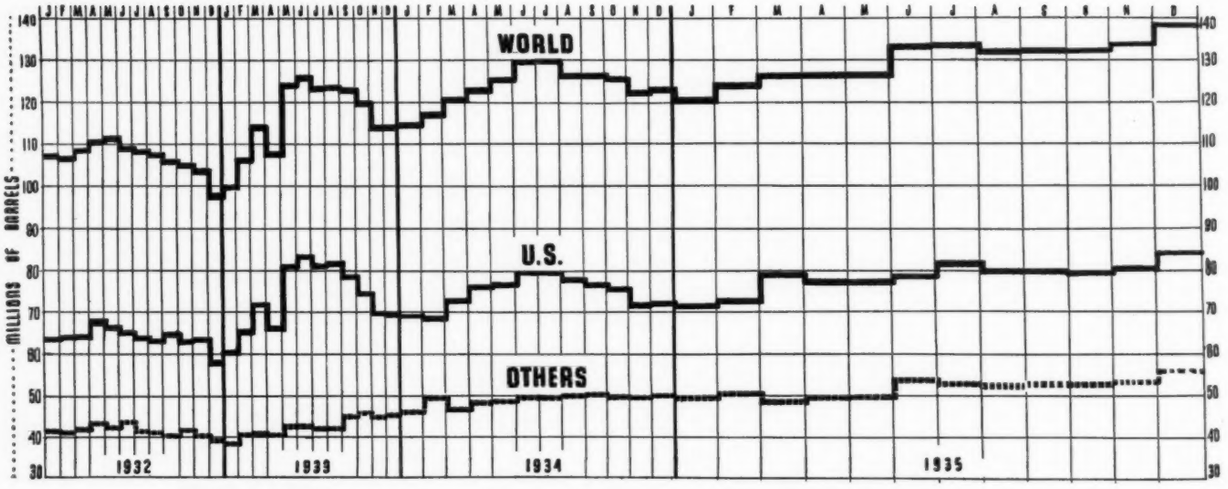
of the manufacturing department. In 1919 he was elected director and also president of the Standard Transportation Company, a subsidiary in charge of the marine operations of this company. In 1932 he became president of the Standard

F. S. Fales

Oil Company of New York, and following the merger with the Vacuum Oil Company, became vice-president and a director of Socony-Vacuum. In 1934 he became Treasurer.

World Crude Production Increased 121,752,000 Bbl. in 1935

U. S. Producing 60.92 Percent of World Total Increased Output by 80,142,000 bbl.—Venezuelan Production Up 9,800,000 bbl.—Russian Increase Limited to 8,040,000 bbl.



World crude oil production trend by months, 1932–1935. Chart is weighted to compensate for variation in number of days per month. Ratio of U. S. crude production to world production.

World Oil Production—Official Figures for 1935

All figures furnished direct to WORLD PETROLEUM by Governments, except where otherwise specified

(Figures in U. S. Barrels—Conversion ratio 7 bbl. = 1 ton:)

Country	January 1935	February 1935	March 1935	April 1935	May 1935	June 1935	July 1935	August 1935	September 1935	October 1935	November 1935	Provisional Figures December 1935
United States	78,715,000	72,763,000	81,488,000	78,427,000	82,454,000	82,338,000	85,485,000	84,816,000	84,109,000	88,160,000	86,476,000	84,018,432
Russia	13,356,000	12,709,900	14,140,700	14,092,400	15,248,800	14,232,400	14,777,000	15,091,300	14,849,100	16,040,500	16,050,000[1]	16,100,000
Venezuela	12,818,414	11,287,605	11,703,825	11,869,900	12,175,022	13,075,118	13,429,885	12,628,067	13,151,362	13,681,619	13,152,776	12,898,759
Iraq[5]	425,000	1,631,000	2,258,123	556,500	1,085,000	4,200,000	1,739,348	1,739,255	1,966,524	1,739,348	1,683,240	2,246,797
Roumania	5,355,000	4,860,000	5,256,000	5,008,000	5,035,000	4,842,000	5,075,000	5,030,000	4,932,000	5,181,000	5,215,000	5,157,067
Iran[2]	4,410,714	4,109,665	4,879,000	4,088,000	3,927,000	4,200,000	4,249,000	4,634,000	4,270,000	4,109,000	4,522,000	4,816,000
Mexico	2,894,167	2,661,632	3,519,148	3,120,035	3,529,659	3,453,871	3,573,632	3,570,908	3,442,259	3,461,457	3,340,713	3,666,088
Netherland India	3,618,272	3,244,717	3,539,564	3,438,848	3,517,360	3,463,061	3,531,857	3,699,430	3,661,259	3,767,596	3,528,889	3,620,769
Colombia[4]	1,653,647	1,141,696	1,466,821	1,377,299	1,486,896	1,518,460	1,639,054	1,567,307	1,555,676	1,623,372	1,582,952	1,004,474
Argentina	1,114,235	1,107,420	1,260,468	1,514,968	1,203,017	1,161,638	1,198,550	1,198,537	1,152,919	1,200,698	1,193,434	1,198,000
Peru[6]	1,418,320	1,269,077	1,395,532	1,329,215	1,451,436	1,414,588	1,448,225	1,442,565	1,448,133	1,493,236	1,343,848	1,381,031
Trinidad	915,220	843,619	919,848	899,946	953,108	972,904	988,341	1,003,382	992,445	1,015,492	1,078,957	1,086,530
British India	781,170	708,159	773,572	756,461	794,968	768,692	791,774	796,150	775,133	760,182[1]	735,660[1]	770,182
Poland[1]	307,000	297,000	309,000	330,000	340,000	314,490	324,973	274,040	308,220	318,494	308,220	318,494
Brunei	269,794	241,927	264,390	267,603	277,550	269,290	283,430	281,400	256,480	233,310	242,900	274,540
Sarawak	183,300	136,500	152,250	151,067	155,400	150,850	151,830	154,000	145,600	148,400	141,400	140,700
Japan	171,441	151,797	164,174	167,728	154,150	144,160	146,863	152,290	144,312	158,165	145,749	148,393
Egypt	112,147	100,086	104,419	94,955	100,555	99,260	103,488	104,937	100,954	103,341	96,495	94,969
Ecuador	147,315	139,555	151,366	145,212	147,245	137,806	144,812	135,549	138,986	147,449	143,518	146,541
Canada	124,654	111,545	120,537	108,506	122,636[1]	120,102	118,812	117,652	123,919	122,525	116,756	119,427
Germany	287,518[3]	223,153[3]	277,942[3]	240,464[3]	285,747[3]	257,369[3]	276,990[3]	241,801[3]	229,712[3]	232,659	236,789	263,879
France	43,078	34,510	44,191	46,284	46,991	46,000[1]	45,276	46,312	43,530[1]	44,981[1]	43,530[1]	44,981
Others[1]	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000
Total	129,196,406	119,848,563	134,263,870	128,105,391	134,566,540	137,255,059	139,598,140	139,096,882	137,872,523	143,817,824	141,453,826	139,591,053

[1] Estimate. [2] Anglo-Iranian Oil Co. figures revised; fuel oil returned to the ground has been deducted. [3] Thuringia estimated 7,000 bbl.; official figure for Prussia. [4] International Petroleum Company's figures. [5] Iraq production estimated for 1934 on basis of total year's production represented by oil shipments through Tripoli and Haifa starting January 1935 plus oil necessary to fill line initially. [6] International Petroleum Company and Lobitos Oilfields Ltd. figures.

Russian Sakhalin included with Russia. Japanese Sakhalin included with Japan.

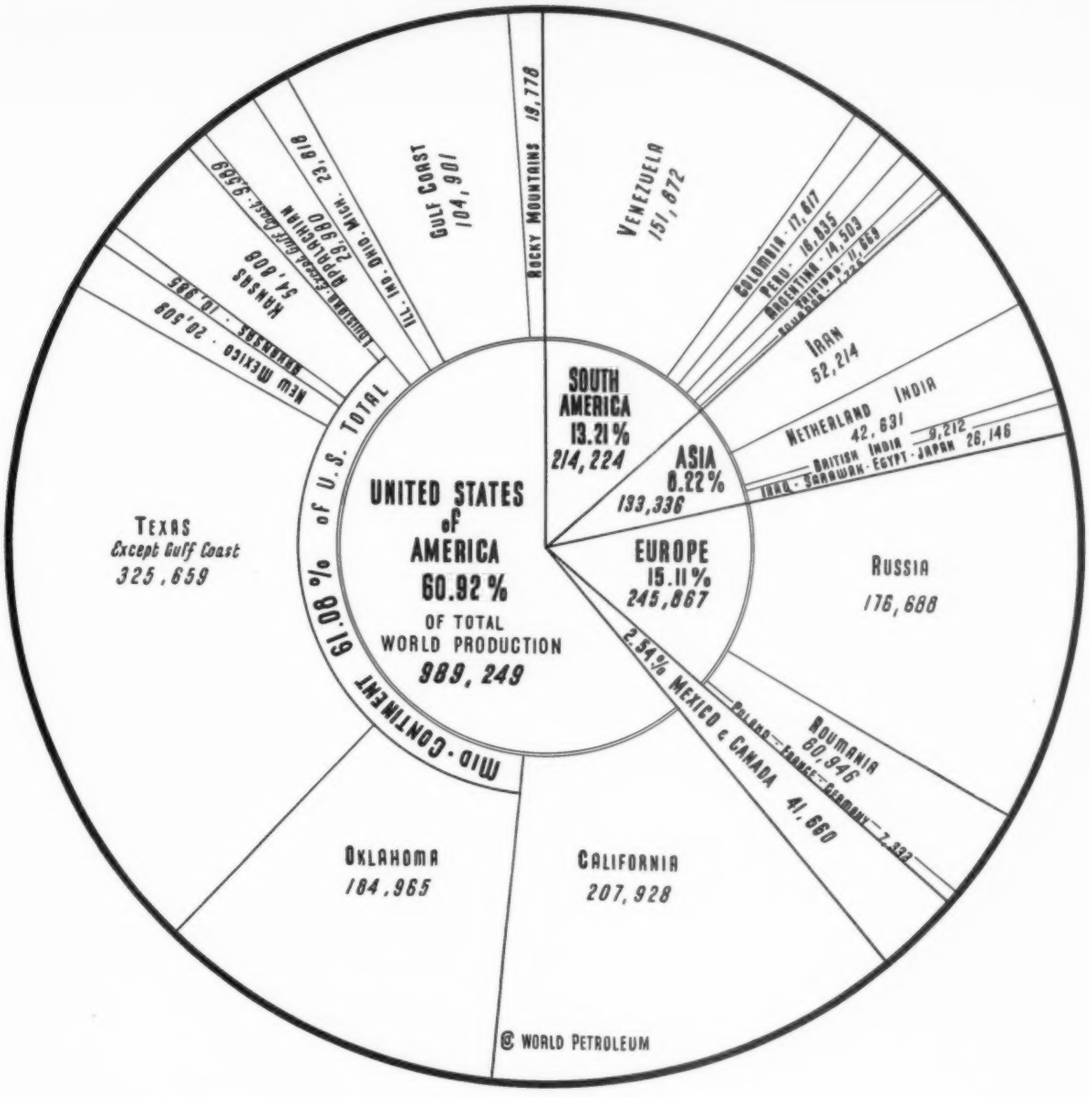


Chart shows world crude oil production by continents, countries and major divisions. Production figures given in barrels of 42 U. S. gallons: 000 omitted. Data based on official government figures.

Official Crude Oil Production 1932 to 1935

Country	Total 1935 to December 31	Daily Average 1935 to November 30	Total 1934	Daily Average 1934	Total 1933	Daily Average 1933	Total 1932	Daily Average 1932
United States	989,249,432	2,691,582	909,107,000	2,490,704	898,874,000	2,462,670	785,159,000	2,145,243
Russia	176,688,100	469,608	168,648,700	462,051	149,901,900	407,950	149,719,000	409,070
Venezuela	151,872,352	416,089	142,072,329	389,239	120,882,802	331,186	119,596,512	326,766
Iraq	21,270,135	56,956	71,921,468*	6,607	1,200,000	3,288	1,200,000	3,300
Roumania	60,946,067	166,357	62,006,000	169,879	50,971,200	139,647	50,491,205	137,954
Iran	52,214,379	141,127	52,663,782	144,284	49,581,280	135,840	45,122,455	123,285
Mexico	40,233,569	109,275	38,167,022	104,567	33,904,882	92,890	32,802,285	89,624
Netherland India	42,631,622	116,799	42,289,408	115,861	38,512,663	105,516	39,584,027	108,153
Colombia	17,617,654	49,740	17,340,724	47,509	13,157,127	36,047	16,384,956	44,768
Argentina	14,503,884	40,030	14,045,652	39,015	13,739,565	38,232	13,166,900	35,975
Peru	16,835,206	46,270	15,936,937	43,663	13,923,281 –	38,146	9,899,266	26,026
Trinidad	11,669,792	31,686	10,894,363	29,847	9,560,039	26,192	10,023,780	27,387
British India	9,212,103	24,522	8,997,399	24,650	8,721,655 +	23,893	8,600,312	23,500
Poland	3,749,931	10,274	3,697,617	10,130	3,858,085 –	10,570	3,905,230	10,670
Brunei	3,162,614	8,647	2,673,041	7,323				
Sarawak	1,811,297	5,002	1,948,044	5,337	2,289,472 –	6,273	2,274,043	6,213
Japan	1,849,222	5,109	1,484,962	4,068	1,377,761	3,827	1,575,333	4,375
Egypt	1,215,606	3,356	1,479,037	4,052	1,591,495	4,360	1,742,370	4,760
Ecuador	1,725,354	4,727	1,655,062	4,534	1,622,624 –	4,446	1,573,857	4,300
Canada	1,427,071	3,917	1,418,810	3,887	1,147,825 –	3,144	1,054,373	2,880
Germany	3,054,023	8,409	2,266,964	6,211	1,712,823	4,692	1,824,019	4,983
France	529,664	1,451	552,000	1,512	552,000	1,515	552,000	1,508
Bahrein			285,071	781				
Others	900,000	2,470	861,000	2,359	432,000	1,184	432,000	1,180
	1,624,369,077	4,413,403	1,502,617,452	4,117,293	1,417,534,489	3,884,022	1,296,712,823	3,544,940

* Official figure: subject to revision.

Price Agreement to End French Market War

An Impossible Situation Created by the French Law of 1928 Governing Importation of Oil May Be Remedied Before a Crisis Is Reached, by Agreement Among Importers. *By E. J. Andre*

A DETERMINED effort is now being made to end the devastating price-war which has crippled the French oil market since November 1934, and negotiations for price agreements are at the present moment being pursued between the different categories of distributors.

For about fourteen months past, this mad war has caused losses on the gasoline market which are estimated at an average of $2,350,000 monthly or over $28,000,000 annually.

The significance of these figures will be better understood when it is realized that the total value of gasoline consumed in France in 1935 was about $50,000,000, so that the losses inflicted by the price-war amount to over 56 percent; it must therefore take many years to make good the losses of the past fourteen months' folly, even assuming that the current peace negotiations end successfully.

It is believed that if agreement is reached, a rise of at most 66 cents per 2,200 gallons can be hoped for (Frs. 10.– per hectoliter) which would hardly cover present losses. If a rise of one dollar is obtained—which in view of the particular circumstances governing the French market, is very unlikely,—it would still require several years to liquidate the losses sustained.

The story of the price war is one of the most curious in the history of the French oil industry. Its causes were innumerable and difficult to determine. Distributors, it must be remembered, are numerous.

The big importers include 41 corporations importing 2,630,600 tons of gasoline and the small importers about one hundred and seventy-six individuals or companies importing roughly 500,000 tons. (Consumption only amounts to 2,300,000 tons.)

As long as the number of distributors was stationary the market remained stable, but uneconomic competition naturally broke out when the number began to increase.

The creation of new importing corporations in France was greatly stimulated by the Act passed in 1928 which set up two categories of importers:—

1) the big corporations which have the right of bringing in a determined quantity of products every year for each corporation individually. These corporations became known as the "Specially Authorised"

2) the corporations which import less than 300 tons monthly. These, known as the "Generally Authorised", were free of the obligations and responsibilities which from the nature of their business fell to the big corporations.

The details of the obligations imposed upon these two different categories have been explained previously in these pages and need not be enumerated again, but it is easy to see how, in the circumstances, the small operator tended to look upon the "General Authorisations" as heaven-sent manna.

Any one obtaining a "General Authorisation" could immediately obtain the funds necessary to exploit it. Thus, a ton of gasoline imported into France costs about $25.33. The heavy taxes and import duties amount to about $145. It is obvious that to import and sell 100,000 tons requires a working capital of at least $2,533,333 to buy the goods, and a further $135,000,000 to pay the taxes, but that no corporation distributing 100,000 runs to a capital of $150,000,000.

The state grasped that fact and, estimating that it takes four months to sell a given imported quantity of products, granted the importer a four months' credit for the payment of his taxes, with the result that all the importer needed was to raise the necessary funds to buy the gasoline! The banks which financed these operations found themselves face to face with extraordinary opportunities for a quick turn-over of short term capital, and some of them were accordingly tempted to encourage the creation of oil importing corporations.

The mechanism is better explained by the following example: An insignificant bank, without influential connections and without business, discovers that on a commodity worth 1 cent the state will give a four months' credit—that is to say nearly 7 cents, or for $500,000 it can obtain $3,500,000 for a period of four months. Obviously this credit can be conveniently used for all sorts of purposes, and against the day when the debt falls due, the bank can by paying up a sum of $500,000 obtain a new credit of $3,500,000 and so on *ad infinitum*.

Those banks which financed the oil importing business therefore had every interest in encouraging the multiplication of importers, whom they used as a heaven-sent means of cashing in on the apparently inexhaustible flow of state credit. Thus it was that the ever increasing number of distributors destroyed the equilibrium established by the previous agreements. The French oil war had begun.

The numerous oil corporations which have strictly confined themselves to genuine business during this chaotic period have been forced to examine the possibilities of putting an end to practices which at least can be called dubious. Hence the present negotiations.

A first step towards a re-establishment of order was taken when the government passed an Act abolishing the "General Authorisations", obtainable for the asking. Oil importations, in small or large quantities, are now governed by the same regulations, so that if the oil price-war is not yet ended, at least the multiplication race has been stopped.

There remains the task of reorganising the market—swollen as it is by a large number of uneconomic units—through price agreements.

THE MOST serious difficulties will probably arise through the Act of the government in 1935, reducing the authorised imports of the refineries by 10 percent. This was a terrible blow to those refineries which had been built on the understanding that their output would actually be

increased. The reason for this reduction is not known and nothing in the oil refining situation seems to justify it. The generally accepted belief is therefore that the government intends to allow a new refinery to be built in order to give satisfaction to the Roumanian oil corporations which are known to wish to refine their own crude oil in France. Any explanation, however, is liable to a denial.

This, in brief outline, is the situation. It is indeed complicated by a number of other problems, but they are not essentials and, as it is hoped, matters may improve shortly.

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Prospect for U. S. Oil Sanctions Dims

It Appears Unlikely that Government Will Take Steps to Embargo Shipments to Belligerents. Excise Tax on Imported Oil May be Postponed Until After Election.

By Don J. Kirkley

WASHINGTON, JANUARY 31, 1936

WHAT President Roosevelt wants to do about oil, on the national as well as the international front, today holds the key to what will be done in Washington.

In brief, that is the way the Washington whirligig spins at the moment as February opens and January ends, attention is focussed on the White House in an effort to find out what the Chief Executive wants to do about:

1. Limiting oil shipments to belligerent nations under the revision of the neutrality law.
2. Putting an excise tax on imports of petroleum and its products.

Once prepared to rush through the legislature any proposal that seemed reasonable for curtailing imports, Congress has changed its mind—presumably the result of a suggestion from the White House that since this is election year, taxes that hit the consumer are not good campaign fodder.

Be that as it may, the Ways and Means Committee of the House, in which excise tax and other tariff legislation must originate, has a gentlemen's agreement among virtually all its members, not to act on any excise tax proposals, whether affecting oil or another commodity until the clear signal comes from Mr. Roosevelt.

As one member of that committee put the situation: "I personally should like very much to see imports of oil and its products limited; the producers of my state tell me that they are losing markets to imports, but—if we pass an excise tax on petroleum, there are 21 other excise tax bills on as many things in the committee and each committee member authoring them will demand action."

Regardless of this general spirit in the committee, Wesley E. Disney, Democratic Representative from Oklahoma, and a member of the Ways and Means Group, on January 22 decided to go it alone to see if the Independent Petroleum Association's program could be enacted into law and provide flat limitation of imports to 4.5 percent of the daily domestic demand, the doubling of all the excise taxes now in force, with the exception of gasoline, which would be left alone, making bunkering supplies come under the tax, and authorizing the president to establish import quotas.

Off the record, it can be said that Disney's bill probably will pass if it ever gets to a vote, since there are enough members of the House and Senate from the 19 producing states to beat back attacks upon the bill from the consuming states. But, it may get strangled in committee.

Intermingled with the question of imports in the minds of legislators and observers following the situation is the matter of exports and what to do about them with respect to American neutrality.

While the Department of Commerce and the Department of State might deny the following sentence, it can be fairly and accurately stated to be a fact:

> The Administration wants but probably will not get, the right to keep oil and other materials of war (as contrasted with direct munitions of war) on a selective list for bargaining purposes.

Congress is very much interested in the petroleum phases of the neutrality question, some of the members having been informed that the only thing that kept this country from joining an international oil embargo against Italy was that the League of Nations failed to back up its threats.

In addition, a number of members of Congress have, very quietly, called upon the Department of Commerce to give them statistics covering American oil trade with Italy and her African colonies over the past several years and the past few months. These data show, among other things, that:

1. Shipments in October and November of 1935 amounted to approximately 750,000 bbl. of crude and 150,000 barrels of gasoline, as compared with 445,596 and 61,825 during the entire year 1934.

2. That shipments of gasoline to Italian colonies in Africa amounted to virtually nothing in 1934, but totalled 139,320 bbl. during the last 90 days of 1935, according to incomplete figures.

3. That shipments of crude, gasoline, gasoil and distillate fuel oil, and residual fuel oil, totalled far more in November than in October, with the Department's reports showing that November shipments to Italy: amounted to 316,955 bbl. of crude, 78,284 bbl. of gasoline, 58,214 bbl. of gasoil and distillate fuel oil, and 100,289 bbl. of residual fuel oil.

October shipments comprised 417,474 bbl. of crude and 22,822 bbl. gas oil and distillate fuel oil.

As a result of the potent ramifications of conflict across the Atlantic, the current Congress is likely to go slow when and where dealing with oil, and is completely sold on the idea that the domestic industry is best left alone right now.

William P. Cole, Jr., Democratic Congressman from Maryland, chairman of the Special House Oil Committee, and members of his group now anticipate no oil action other than what may be done about limiting imports, a question which

will not come before them as a committee.

Apace with these major domestic and international petroleum developments, two others of considerable importance promise to have repercussions in Congress.

One was an effort by the producing states, through representatives of the Interstate Compact Commission who spent several days in the Capital, to get a larger allowable for their commonwealths to meet demand from current production and not from storage.

This effort came indirectly in an appeal to the Bureau of Mines to make an inventory of stocks in the United States to determine how much of the oil in storage was usable, how much bottom stuff and how much water and pipeline fill.

They contended that the Bureau's figures showing 298,000,000 bbl. of oil above ground really meant about 100,000,000 bbl. less in terms of usable oil, assigning the 100,000,000 bbl. to pipeline fill, water and bottom stuff. On top of this, they argued that the best stock position for the industry was to have at least 250,000,000 bbl. of usable crude above ground at all times, pointing out that this total was about 100 days' supply.

The Bureau, it may be predicted with reasonable accuracy, is friendly toward the idea and has asked Congress for the $37,500 estimated cost of the inventory, and an additional $15,000 so that it may continue its forecasts of demand each month. Congress probably will give it $25,000 with which to do both jobs.

The second matter brought natural gas into the position heretofore held by petroleum: that it needed regulation because of waste, competitive over-drilling, and vicious competitive practices.

These were the findings of the Federal Trade Commission in a voluminous report to the Senate, which shortly will be followed by a draft of legislation. Whether the legislation will get anywhere is doubtful, since it resembles the type of regimentary proposals recently abruptly checked by the Supreme Court in its NRA and AAA decisions.

However, the Trade Commission bill has this chance:

A sudden switch in Roosevelt plans, which may come about March 15, may bring an effort by the Administration to make a major political issue out of the basic question of whether the central government shall have power to regulate commerce, agriculture, labor and industry for the general welfare and in the commonweal. At this moment, Mr. Roosevelt does not expect to raise the issue.

But, as in all political camps, conditions may demand a change in strategy.

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Accelerated Improvement Expected in England

While a Number of Factors Limited the Extent of Earnings Improvement for British Companies During 1935, a Definitely Optimistic Outlook Prevails for 1936.

By Alec H. Day

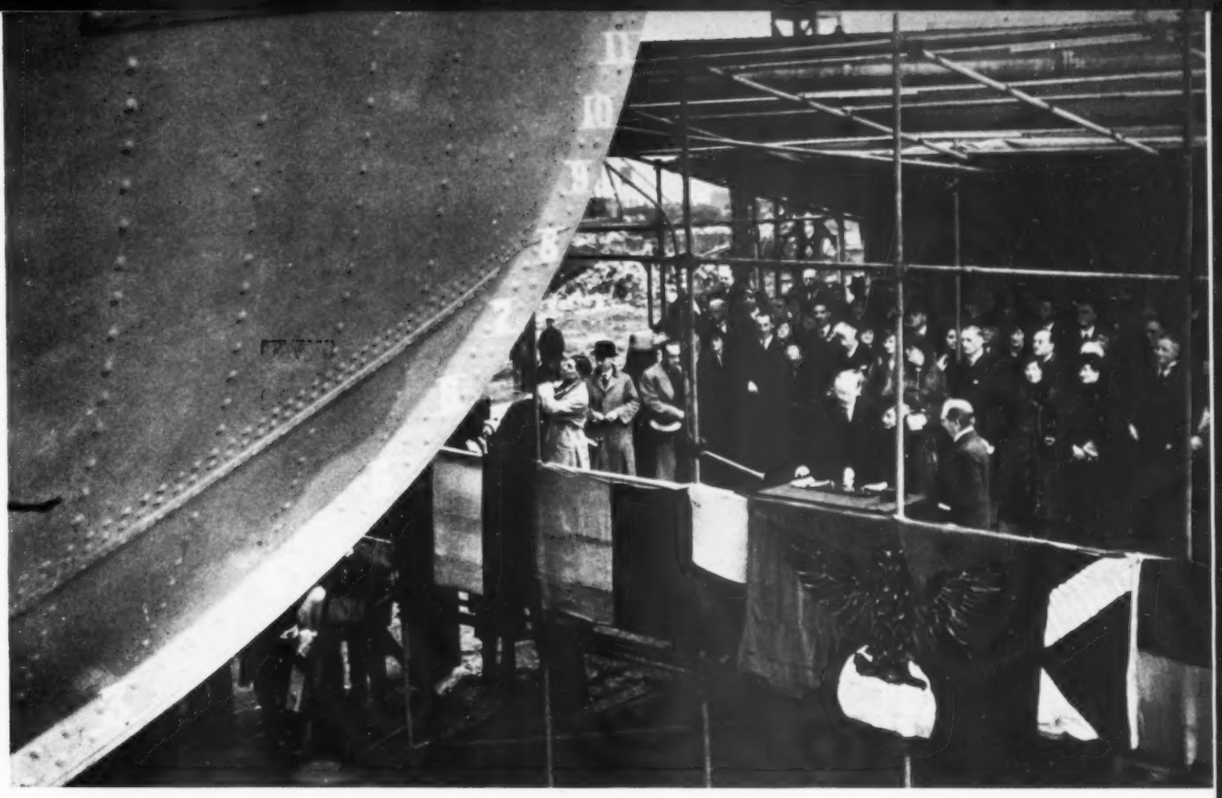
OPERATING as producers and distributors in many quarters of the world, British oil companies are subject to widely differing local circumstances, and considerable variation in their experience during 1935 is to be expected. Improvement in world marketing conditions should nevertheless have left them with a generally higher level of profit last year than in 1934.

This applies to the larger undertakings distributing in Britain itself, although a comparison of British prices with American and Roumanian export quotations does not present a particularly rosy picture of import business. Gulf and Constanza values advanced in 1935, but quoted British prices for oil products show little change on the year, and the rise in motor spirit in the United Kingdom last May can have done hardly more than offset the higher cost of imported spirit.

For the first four months of 1935, posted price of first grade spirit remained at 1s. 5d. per gallon, and was raised on May 1 to 1s. 6d., at which it remained until the end of the year. The average for the twelve months was thus 1s. 5.67d., which compares with 1s. 5.22d. for the whole of 1934, the rise of approximately ½d. per gallon in the year's average leaving no improvement in the profit margin if higher cost, freight and insurance is taken into account. About one half of the total sales of motor spirit is for commercial consumers, and bulk contracts are mostly around 1s. ½d.

Absence of substantial improvement thus indicated in the profit margin on motor spirit applies, however, mainly to the smaller independent distributors, purchasing their oil overseas. Few of the smaller independents, however, have any important sales at the pump, for the most part selling in bulk to transport companies. The great majority of the larger concerns, producing and transporting on their own account or through allied concerns, are in a position to profit directly from the rise in British prices for motor spirit.

Although the average advance has been small, and is considered in many oil quarters to be less than current conditions warrant, it represents a considerable sum when applied to the country's bulk consumption. Assuming a total demand in Britain for 1,200,000,000 imperial gallons during 1935, a rise of ½d. per gallon means a total increase in gross sales income of over £2,500,000. This is admittedly a rough and ready deduction, since a large proportion of the motor spirit business handled in Great Britain consists of contracts with big consumers of commercial spirit. But the upward trend of the price has undoubtedly had



Anglo-American Oil Company's new 10,250 ton lubricating oil carrier, Comanchee, recently launched at Clydebank. *See page 70 for further details.*

its influence on the general price level for this class of business, and to the majority of the larger distributors in Britain the rise in motor spirit prices must have meant so much more profit.

Increased consumption of motor spirit has also contributed to conditions making for higher oil profits. Official figures show the demand for spirit to have been 1,030,248,181 imperial gallons (29,435,662 bbl.) during the first ten months of 1935, compared with 978,141,509 imperial gallons (27,946,900 bbl.) in the corresponding period of 1934, an expansion of 5.3 percent.

British demand for products other than motor spirit has shown little or no expansion last year, aside from an increase in fuel oil consumption. Prices for these products have also been less favourable to sellers, British quoted prices having failed to respond to the higher level of values in export markets, and remaining unchanged practically throughout the year. There is, moreover, little or no evidence of improvement in the values at which actual business has been negotiated.

Recently the market for lubricating oil has been subjected to a good deal of price cutting by small merchants, and the profit on kerosene and fuel oil can hardly have been better last year than in 1934.

Larger consumption of motor spirit at a higher average price will therefore have made the major contribution to gross trading profit increases achieved by producer-distributors in the British market, but even if a general improvement in gross profit is assumed, this does not imply an equally general rise in net earnings.

Three factors which seem likely to enter prominently into some net profit calculations for 1935 are increased efficiency and resulting reduction in distribution costs; refinery changes and consequent depreciation charges; and advertising expenditure. No close study of refining and marketing in Britain is necessary to show that these items have varied widely between one company and another. The result may be correspondingly wide variations in net profit experience.

That the profit trend during the past year has been reasonably good in some cases is suggested by the chairmen of two of the largest British oil companies concerned mainly with distributing in Britain. At the Anglo-Iranian meeting half-way through the year, Sir John Cadman stated that the balance of definite indication regarding results for 1935 was favourable. There has since been no definite change for the worse, and the chairman of Trinidad Leaseholds told shareholders in October that during the company's current financial year, which runs from July 1, results had so far been satisfactory. Conditions affecting these two companies have probably applied to other undertakings distributing in Britain.

British oil companies operating in other markets should also have found trading better in 1935. In India, where distress sales of products depressed oil prices severely in 1934 and during the earlier part of 1935, the position has been improving in recent months. Companies dependent on the United States price level, and on the dollar-sterling exchange, should have earned larger profits in addition to deriving benefit of a relatively stable exchange rate. The Roumanian industry has experienced a definitely better year, largely through the reactions of the Italo-Abyssinian war. There is no reason why British companies operating in the country should not have participated in the recovery as far as sales income is concerned, although the war has evidently created new problems in Roumania, as in other parts of the Continent, relating to exchange dealings and actual payments for sales of oil products.

Recent dividend announcements by British oil companies have been encouraging, Anglo-Ecuadorian increasing its annual dividend from 5 percent to 7½ percent, while Anglo-Iranian has confirmed the chairman's suggestion of better trading by resuming interim dividend payments after a lapse of several years. Keen disappointment was caused by the recent decision of the Royal Dutch and Shell directors to defer action on an interim dividend, but it is held that this decision was due to the difficulty of exchange markets, and to the possibility of the imposition of oil sanctions, rather than to any lack of actual earnings by the Group. However, an improvement in total 1935 dividends over those paid in 1934 is anticipated by the share market.

Well-informed Stock Exchange observers are looking for a rise in the general level of British oil profits last year, and market sentiment in relation to oil shares has changed sharply for the better.

Share values have responded to the change, and the accompanying table, comparing prices of five leading shares at the end of 1934 and 1935, suggests that part at least of the expected improvement in earnings has already been discounted.

Showing an average rise of approximately 50 percent in values, the table indicates the extent to which market confidence has been restored during the past year. The price rise has naturally been accentuated by the exceptional depression existing at the end of 1934, resulting from a long period of low oil prices and the uncertainties of the American oil situation. Anticipations that the past year's improvement in the United States industry will be continued is at the base of the more favourable view now being taken of the outlook, which must however, also be affected by the immediate course of events in Europe.

Year's Rise in London Oil Share Prices

	End 1934	End 1935	Rise percent
Anglo-Iranian	2 1/16	3 13/32	65.2
Burmah	3 17/32	4 1/16	15.0
Lobitos	1 ½	1 13/16	20.8
Shell Transport	2 3/16	4 1/32	84.3
Trinidad Leasehold	2 17/32	4 3/32	61.7

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Peru Faces 50 Percent Tariff Increase

Difficulties Arising Out of a Recently Completed Chilean-Peruvian Trade Agreement Have Led Argentina to Threaten Peruvian Crude With Prohibitive Tariff.

WHAT may amount to a serious trade difference between Argentina and Peru has just materialized, and has as its background the new commercial treaty between Peru and Chile which has just been concluded. Argentina unofficially charges discrimination, in the sense that the Chilean-Peruvian agreement provides, according to reports, duty free entry of Chilean wheat up to a total of 40,000 tons, and beyond that figure a reduction of 50 percent of the duty on all such cargoes. Presumably, this preferential treatment of Chilean wheat will stimulate the production in Chile, although it is understood that at the present time it is perfectly possible for Chilean merchants to buy Argentine wheat in Buenos Aires, direct it through the Straits of Magellan, and into a Chilean port, where it can be nationalized, and then forwarded to Peru, where it will be accorded the preferential treatment described in the treaty.

During the past few months efforts have been made by the Argentina representative in Lima to conclude some sort of a trade agreement between these two countries, but so far no success has attended these efforts, and the introduction of the new agreement with Chile constitutes the foundation for Argentina's claim of discrimination. As a result of this condition, Argentina has undertaken what amounts to a measure of practical retaliation, that is, a decree has just been signed by the Executive Power which provides that on and after December 27th the Argentine duty on crude petroleum from Peru will be increased by 50 percent. This decree has not been promulgated, but has been informally given to the press, probably with the idea in mind that its publication may produce the desired effect upon Peru. At the moment the duty on crude petroleum from Peru is 20 pesos per ton, plus the 10 percent surtax, bringing the aggregate to 22 pesos per ton. If the 50 percent increase goes into effect, the new duty will amount to 32 pesos per ton.

During the past eighteen months, particularly since the American oil companies have opened refineries in Argentina, imports of crude petroleum from Peru have appreciated considerably. During the first nine months of 1935, total crude petroleum imports amounted to 318,116 metric tons, and of this aggregate Peru supplied 181,737 metric tons. The Peruvian crude is said to be especially adaptable to refining processes employed in Argentina. The average C.I.F. value of this crude has over a period of some months worked out at approximately $1.35 U. S. Cy. per barrel, and if the increased duty is applied it will amount to something like one peso a barrel extra, or an increase of approximately 18 percent.

It is presumed that the postponement of the effective date of the Argentine decree against Peruvian crude is due to the desire of the Argentine officials to effect if possible an amicable settlement with Peru. There is every reason to believe that the Argentine national petroleum industry, better known as the Y.P.F., would encourage any development which would make the domestic oil distributors more dependent upon internal supplies, and for this reason it can be expected that the Argentine Government will be most insistent upon Peru granting clear recognition of the most favored nation principle. In the meantime, American oil companies in this territory report that cargoes of crude which were scheduled to arrive before December 27th have been expedited in their delivery, and that future shipments are being canceled until it is definitely known whether Peru will take any action to meet Argentine demands. Should the new duty actually become operative, it will be a practical impossibility to import crude from Peru, and cargoes will very probably be secured from northern South American countries.

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Front Cover

OUR front cover picture this month shows the completion of the largest pipeline in Russia at the crossing of the Ural River. The line runs from Guryev on the Caspian Sea to Orsk in Kazakstan, a central point in what will develop into an important consuming center. Photo published through the courtesy of Sovfoto.

Foreign Oil Legion

Alexander Lowe McColl

Wilson Cross, formerly chairman and managing director of Vacuum Oil Company, Ltd., retired from that company in January under the 65 year retirement policy of the Standard Oil group. He sailed from England for New York on January 11 and expects to travel to California and Honolulu after a few weeks of golf in Florida. Mr. Cross is one of the most widely known men in the petroleum industry. He has been with his company for 40 years, having been born and educated in Cincinnati, Ohio. In January 1896 he joined the Pennsylvania Lubricating Company and remained with that company until it was absorbed by Vacuum in 1906 except for a short period as lieutenant in the United States artillery during the Spanish-American War. In 1906 Mr. Cross moved from Liverpool to London and in 1913 was appointed a director of the Vacuum, becoming chairman in 1932. At that time he also became director of the Iraq Petroleum Company and of Mediterranean Pipelines, Ltd. Mr. Cross has a remarkable collection of autographed photographs of practically every prominent man in the petroleum industry, one corner of his extensive collection appearing in the accompanying illustration.

Alexander Lowe McColl formerly deputy chairman and joint managing director of Vacuum since 1933 becomes chairman of the board of directors on retirement of Mr. Cross. Mr. McColl, who is a native of Kilmarnock, joined the company in 1905 and in 1919 became a director.

Raymond M. Parker, Jr., has been elected President of the Hartol Products Corporation to succeed the late Frank C. Hart, recently killed in the crash of an airliner in Arkansas. Mr. Parker has been vice president in charge of sales of the Hartol Products Corporation since 1932. Mr. Parker has been in the oil business during the past twenty years, starting with the Union Petroleum Company in Philadelphia after his graduation from Penn Charter School in that city, later becoming vice president of Richfield, where he remained until his association with Hartol Products Corporation.

Wilson Cross

E. R. Lederer

E. R. Lederer, recently chairman of the Labor Committee for the Petroleum Administration in Washington, and active in petroleum code work at Washington since 1933, has taken offices at 80 Broadway, New York City, where he will act as a consulting petroleum engineer and economist. Dr. Lederer received extensive engineering training at the University of Heidelberg and holds the degree of Ph.D. from the University of Vienna. He has had varied experience as a petroleum chemist and refinery engineer and has published works on oil economics.

UNITED STATES

	Daily Crude Oil Production bbl.	Daily Runs to Stills bbl.	Total Motor Fuel Stocks bbl.	Imports for week bbl.	California Shipments East for week bbl.
Week ending Dec. 7	2,805,000	2,675,000	52,437,000	432,000[2]	none
	448,000[1]				
Week ending Dec. 14	2,879,500	2,770,000	53,942,000	1,346,000[2]	272,000
	450,500[1]				
Week ending Dec. 21	2,864,000	2,750,000	54,633,000	1,147,000[2]	175,000
	449,000[1]				
Week ending Dec. 28	2,837,500	2,790,000	55,889,000	761,000[2]	none
	453,000[1]				
Week ending Jan. 4	2,806,000	2,645,000	56,936,000	1,267,000[2]	77,000
	448,500[1]				
Week ending Jan. 11	2,819,000	2,715,000		594,000	118,000
	440,500[1]				
Week ending Jan. 18	2,885,600	2,810,000		855,000	161,000

Underlined figures indicate improvement in statistical position—decrease in production, runs to stills, gasoline stocks and imports.

[1] Estimated total production of the East Texas field, official and unreported.

[2] Import figures include all oil imported, for domestic use and in bond for re-export, it being impossible to make the separation in weekly statistics.

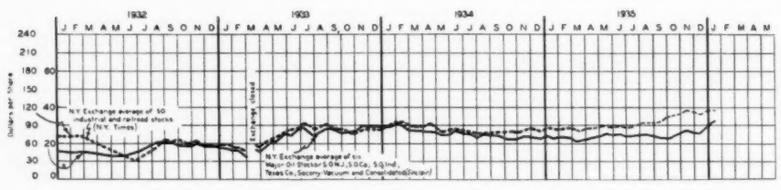
Guffey Coal Bill to Follow AAA

ON JANUARY 6th, 1936, the United States Supreme Court ruled the Agricultural Adjustment Act (A.A.A.) unconstitutional in such terms that presage just as sweeping a defeat to the Guffey Coal Bill. This is of great importance to the oil industry, since similar legislation, if held constitutional, could be easily enacted to exercise strict federal control over all natural resources. The Court stated: "If the act before us is a proper exercise of the Federal taxing power, evidently the regulation of all industry throughout the United States may be accomplished by similar exercises of the same power". Two sentences from the decision, quoted herewith, bear directly on the Guffey Coal Bill. "We conclude that the act is one regulating agricultural production; that the tax is a mere incident of such regulation . . ." and "Congress has no power to enforce its commands on the farmer to the ends sought by the Agricultural Adjustment Act. It must follow that it may not indirectly accomplish those ends by taxing and spending to purchase compliance". The A.A.A. decision of the Supreme Court has been held throughout the country as "epochal"; it means probable invalidation, in addition to the Guffey Coal Bill, of the Cotton Control Act, the Utility Holding Company Act and several other New Deal measures now pending either before the Supreme Court or before the lower courts, but destined to reach the Supreme Court within the next few months. The decision similarly makes it highly improbable that any federal legislation at all affecting the oil industry will be even considered in the current session of Congress. Congress will be preoccupied with more fundamental measures and, in addition, the oil industry has fairly well solved its difficulties under limited state control with the aid of the Connally Contraband Oil Bill, assisted by heavy domestic consumption and exports of petroleum and its products in 1935.

At the January 16th monthly hearing of the Texas Railroad Commission the commissioners were again confronted with the request of a large group of operators in the East Texas field for inclusion of acreage factor in proration. Meanwhile a group of independents, represented by J. Blalock, threatened a breakdown in proration if present status-quo is upset and at the same time requested higher allowable production for the whole field. The point at issue, in addition to the inclusion of the acreage factor, is that such more equitable proration will result in cessation of unnecessary drilling which is still continuing at a rate in excess of 200 completions per month, indicating a monthly expenditure of $2,800,000; an economic waste, possibly harmful to the reservoir, but which must be undertaken under existing offset obligations by all operators in the field. It is not considered likely that the Railroad Commission will change its present potential method of allocating production due to political considerations, but the matter could, and probably will be, appealed to courts under recent State Supreme Court decision in the C. H. Brown vs Humble Oil and Refining Company case reported in the preceding issues of WORLD PETROLEUM. Undoubtedly the continuation of drilling in East Texas field at the present rate will gradually reduce the difference in allowable between good and poor wells to such an extent that both will be practically equal, and the Commission will be forced to increase the allowable from the field against recommendations of its own engineers. It is more than probable that the Railroad Commission would itself welcome a court test of the acreage factor. If favorable, it would be willing to enforce the decision, as long as the initiative did not rest with the Commission and as long as it could not be accused of catering to the interests of major companies.

The Rodessa field in Caddo parish of Louisiana was extended during the past month one-half mile westward into Cass county, Texas, by R. W. Norton's No. 1 Haywood, which was brought in for 1,100 bbl. per day through ½-inch choke from 6,002 ft. in the Öolitic limestone. Thus the Railroad Commission is confronted with another difficult task of prorating the Texas side of the Rodessa pool to conform with other fields in the state and at the same time to prevent drainage across the state line in Louisiana, where wells are still allowed to produce 600 bbl. per day. Up to this writing no decision has been reached, and the extension well is producing 2,500 bbl. per day. The Rodessa pool was also extended to the east during the past month by the Bartex Pipe Line Company's (Phillips Petroleum) No. 1 B. H. Norton, the field now extending 6½ miles from southwest to northeast, being about 1 mile in width, and covering about 4,160 acres.

Six major oil stocks in relation to 50 industrial stocks on the New York Stock Exchange.


1932
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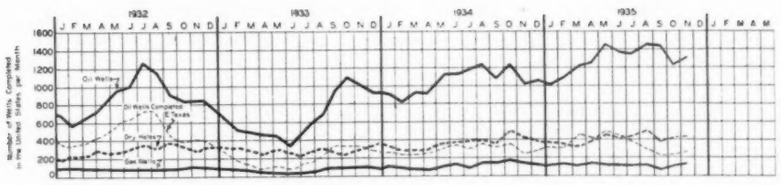
N.Y. Exchange average of 50 industrial and railroad stocks (N.Y. Times)
Exchange closed
N.Y. Exchange average of six Major Oil Stocks (S.O.N.J., S.O.Ca., S.O.Ind., Texas Co., Socony-Vacuum and Consolidated Oil Corp.)

Crude Oil and Gasoline Prices Advanced

THE anticipated advance in crude oil prices was initiated on January 8th by the Sun Oil Company, and was met by all other purchasers within the next few days. Crude oil prices were increased throughout the Mid-Continent territory from 10 to 15 cents per barrel, while a 10-cent advance was posted in the Rocky Mountains, Michigan, Indiana and Illinois and a 15-cent advance in Pennsylvania. The advance in crude oil prices was immediately reflected in higher refinery gasoline quotations throughout the United States, with



U. S. drilling statistics: comparison of oil wells, gas wells and dry holes, with separation of oil wells in the East Texas field.

the exception of the Pacific Coast, the refinery gasoline advance ranging from ¼ to ½ cent per gallon. Kerosene quotations improved about ¼ of a cent per gallon, but natural gasolines lost seasonally about ¾ of a cent per gallon. Service station prices remained unchanged, excepting the Mid-Continent where a 1-cent advance was posted during the middle of January.

On the Pacific Coast the continued high rate of production in California and another price war in Los Angeles weakened the price structure. Gasoline in southern California declined 2 cents per gallon at service stations on January 9th and rumors persisted that a cut in crude oil prices in the fields of Los Angeles basin would be forthcoming if the situation did not improve within the next few weeks.

Posted crude oil prices were advanced on January 8th by the Sun Oil Company 15 cents per barrel in East Texas and Conroe oil fields and 10 cents per barrel elsewhere in Texas. By January 9th the advance was met by all purchasers and was extended into the balance of the Mid-Continent territory; the general increase in price being 10 cents per barrel, excepting East Texas and Conroe where the 15-cent advance of the Sun Oil Company was accepted, as is shown on the accompanying price table. Prices were advanced in the Rocky Mountain area 10 cents a barrel on January 9th and in eastern states on January 13th. The advance of January 8th to 13th raised crude oil prices to the highest level since October of 1930.

The crude oil price advance of early January can be considered as being of intermediate nature and it will be, in all probability, followed by a second comparable advance in April or May of this year at the beginning of the motoring season. The rate of increase in demand in 1936 over 1935 will be an important factor in determination of the actual size of the spring crude oil price advance. An interesting situation developed in Michigan within the last two months where production showed a decline from around 53,000 bbl. per day in October of 1935 to 39,000 bbl. in the week ending January 11, 1936, a decline of 26.4 percent. This decline in production, coupled with the extensive refinery building campaign in that state resulted in demand exceeding supply by a large margin, forcing crude oil prices from $1.02 per barrel before November 7, 1935, to $1.32 per barrel on January 13, 1936. In view of the lack of new discoveries in that state of any importance, Michigan crude oil prices may be expected to be further increased as production further decreases and competition for the crude among the refiners becomes keener.

Tank wagon/service station motor fuel prices per gallon, regular grade, including all taxes, in representative districts in the middle of January were: 14.05/16.8 cents in metropolitan New York (off 1.20/2.7 cents per gallon); 13.8/17.3 cents in Newark, N. J.; 13.5/17.0 cents in Boston, Mass.; 12.5/16.0 cents in Providence, R. I.; 14.0/16.0 in Chicago; 17.0/19.0 cents in Ohio; 14.0/16.0 cents in San Francisco; 11.5/13.5 cents in Los Angeles (off 2 cents per gallon); 17.0/19.0 cents in Oklahoma (up 1 cent per gallon); 16.0/18.0 cents in Dallas and Fort Worth and 17.0/19.0 cents in Houston (up 1 cent per gallon), with third grade gasoline in East Texas area selling at 12 to 13 cents per gallon at independent service stations; 15.2/17.2 cents in St. Louis; and 17.5/20.0 cents in Montreal, Canada (off 3 cents per gallon); all with a 2-cent differential for the premium grade. The indicated declines are only temporary, due in part to slow seasonal demand, and if the crude oil and refinery gasoline improvement in prices persists all tank wagon/service station prices should be stabilized at around 17.0/19.0 cents per gallon.

Refinery gasoline quotations in the Mid-Continent area responded to the crude oil price advance of January 8th and gained around ½ a cent per gallon as compared with quotations prior to the crude advance. Refinery gasoline was quoted on January 15 at 5¼ cents per gallon for 58–60 U.S.M. grade 62.9 and below octane rating in Group 3, Oklahoma market; 63.0–70.9 octane rating, U.S.M., regular grade, was quoted at 6⅛ cents per gallon; and 71 and above octane rating, U.S.M., premium grade, was nominally quoted at 6¼ cents per gallon. East Texas refinery markets also advanced ½ a cent per gallon to 5 cents for the third grade product eligible for interstate tenders, and to 3 to 3½ cents per gallon for gasoline without federal tenders and restricted to intrastate commerce only. On the East Coast at Bayonne, U.S.M. grade, 60.0–64.9 octane rating gasoline again advanced ¼ of a cent per gallon to 6¼ cents (3.69 cents gold *). Gulf Coast quotations for export improved ¼ of a cent per gallon during the past month, reaching 5½ cents (3.25 cents gold *) for grade 58–60 U.S.M. by January 15.

Natural gasolines lost ¾ of a cent per gallon during the past month due to seasonal decline in demand and to the postponement of the solution of gas conservation in Texas Panhandle. On January 15 grade 26–70 was quoted at 3½ cents per gallon (2.07 cents gold *) in Oklahoma; at 3¼ cents per gallon (1.92 cents gold *) in North Texas; and at 5¾ cents per gallon (2.21 cents gold *) in North Louisiana.

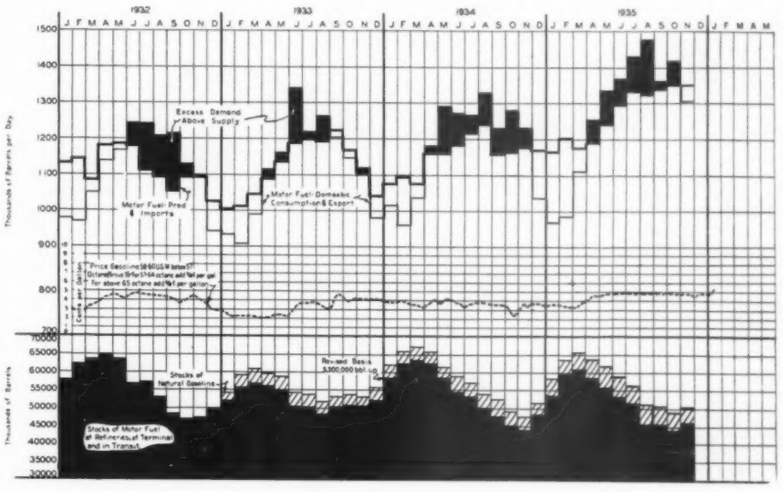
Kerosene quotations advanced about ¼ of a cent per gallon during early January and on January 15 grade 41–43 w.w. was quoted at 3½–3⅝ cents per gallon in Group 3, Oklahoma market; and at 5½ cents per gallon (3.25 cents gold *) on the East Coast at Bayonne. Gulf Coast prices for export remained as yet unchanged from the preceding month at 3⅞ cents per gallon (2.29 cents gold *) for 41–43 p.w. grade and at 3⅞–4 cents per gallon (2.36 cents gold *) for 41–43 w.w. grade.

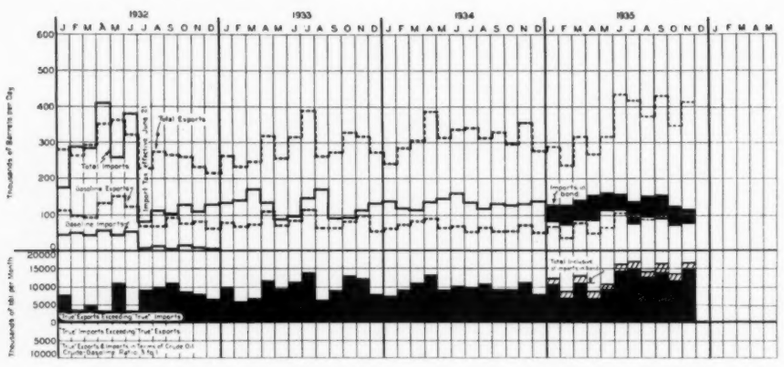
Imports and Exports

DURING November of 1935 total gross imports of crude petroleum and its products into

*U. S. Dollar at 41 percent discount.

U. S. production and imports, consumption and exports and price of motor fuel in relation to motor fuel stocks; showing excess daily demand over supply by black areas.




1932
1933
1934
1935
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M
Thousands of Barrels per Day
Total Exports
Total Imports
Gasoline Exports
Gasoline Importing
Imports in bond
Thousands of Bbl. per Month
Total Exports Exceeding Total Imports
Total Imports Exceeding Total Exports

Total U. S. imports and exports and gasoline exports, indicating imports in bond; and showing evaluation of true exports exceeding true imports.

the United States amounted to 3,482,000 bbl. (116,000 bbl. per day) as compared with 3,809,000 bbl. (123,000 bbl. per day) imported during the preceding month; out of this total during November, 1935, 2,341,000 bbl. (78,000 bbl. per day) were imported for domestic use and 1,141,000 bbl. (37,000 bbl. per day) were imported in transit either for refining and re-export or for use in vessels in foreign trade. During the preceding month, October of 1935, 2,294,000 bbl. (73,900 bbl. per day) were imported for domestic use and 1,515,000 bbl. (48,800 bbl. per day) were imported in bond as indicated above. The crude oil imported for refining and re-export amounted in November, 1935, to 222,000 bbl. During November, 1935, the net imports for domestic use of 78,000 bbl. per day were accordingly 28.1 percent under the former federal recommendation of 108,400 bbl. per day, which was in force under N.R.A.

Exports of crude petroleum and its products during November, 1935, increased 19.72 percent above the daily rate for the preceding month, reaching 12,405,000 bbl. (413,000 bbl. per day), as compared with 10,760,000 bbl. (345,000 bbl. per day) which were shipped during October of 1935, thus again advancing to the high levels reached in the June to September, inclusive, period of 1935. The November, 1935, total exports were 14.41 percent above the shipments in November of 1934, when 10,818,000 bbl. (361,000 bbl. per day) were exported. For the first 11 months of 1935 the total exports of 116,542,000 bbl. exceeded by 10.03 percent the exports during the same period of 1934, when 105,926,000 bbl. were shipped. Exports of crude oil from the United States during November, 1935, dropped 7.88 percent below crude oil exports in the preceding month; reaching but 4,289,000 bbl. (143,000 bbl. per day), as compared with 4,810,000 bbl. (160,333 bbl. per day) shipped in October, 1935, and as compared with 4,680,000 bbl. (156,000 bbl. per day) exported in November of 1934. Therefore in November of 1935 crude oil exports constituted 34.55 percent of the total exports of all petroleum products. During the first 11 months of 1935 crude oil exports amounted to 47,280,000 bbl. (141,600 bbl. per day) as compared with 38,690,000 bbl. (115,900 bbl. per day) shipped during the same period of 1934, an increase of 22.2 percent.

During the first 10 months of 1935 the gross value of exports of crude petroleum and its products amounted to $200,643,018, as compared with the gross value of all petroleum imports of $32,012,892, leaving, therefore, a large favorable balance of $168,630,126. Lubricating oils and greases led in the value of exports in that period of time, being valued at $53,539,140; followed by gasoline valued at $52,303,830; followed by crude oil valued at $51,222,990; by fuel or bunker oil for vessels in foreign trade, not included in domestic exports, valued at $25,568,571; by gas and fuel oil valued at $13,882,235; by kerosene valued at $12,656,423; and by residual fuel oil valued at $7,227,690. The above import figures include imports in bond, and if such imports, valued at $11,103,829, are excluded, then the net favorable balance for the United States is $179,733,955.

Crude Oil Prices Before and After January 8th to 13th Advance

	Before Jan. 8–13	After Jan. 8–13	Advance
Oklahoma, Kansas and Salt Creek, Wyo. (2-cent differential)			
36–36.9 degrees API	$1.00	$1.10	$0.10
40 degrees top API	1.08	1.18	0.10
North Texas (2-cent differential)			
36–36.9 degrees API	0.95	1.00	0.05
40 degrees top API	1.03	1.08	0.05
North Louisiana and Arkansas (2-cent differential)			
36–36.9 degrees API	0.95	1.00	0.05
40 degrees top API	1.03	1.08	0.05
East Texas			
Flat	1.00	1.15	0.15
Gray County, Texas Panhandle (2-cent differential)			
36–36.9 degrees API	0.83	0.90	0.07
40 degrees top API	0.91	0.98	0.07
Texas and Louisiana Gulf Coast			
25–25.9 gravity API	0.94	1.04	0.10
36–36.9 gravity top API	1.10 & 1.12	1.22	0.10
Conroe, Texas (2-cent differential)			
40 degrees top API	1.19	1.34	0.15
West Texas and New Mexico			
Ector, Winkler, Pecos and Lea Counties	0.75 flat	0.85 flat	0.10
Crane, Upton, Howard, etc. Counties	0.70 flat	0.80 flat	0.10
Rocky Mountains			
Elk Basin, flat	1.18	1.28	0.10
Sunburst, flat	1.20	1.20	—
Middle Western			
Illinois, flat	1.13	1.23	0.10
Lima, flat	1.15	1.25	0.10
Central Michigan, flat[1]	1.22	1.32	0.10
Pennsylvania			
Bradford field, flat	2.30	2.45	0.15
In Eureka Pipe Line lines, flat	1.97	2.12	0.15

[1] Central Michigan crude oil was advanced 10 cents per barrel on November 7, 1935, and 10 cents per barrel on December 15, 1935, thus making the total advance 30 cents per barrel in the last 2 months, inclusive of January advance.

Crude Production and Runs to Stills Continue Unseasonably High

CRUDE oil and natural gasoline production during December of 1935 remained high, reaching about 2,990,000 bbl. per day, or only about 18,000 bbl. per day under the all-time record established during the preceding month when 3,008,000 bbl. were produced daily; this volume being 397,000 bbl. per day above crude oil and natural gasoline production in December of 1934, an increase of 15.31 percent. The largest share of this overproduction was again derived from California which exceeded its quota by 5,204,450 bbl., or by 32.70 percent, while Texas overproduced 2,236,406 bbl. and Louisiana overproduced 1,162,173 bbl. Small overproduction was recorded in Oklahoma and Kansas which exceeded their December quotas by 36,375 bbl. and 151,825 bbl. respectively. As indicated elsewhere in this review, the state of Michigan registered a precipitate decline within the last few months due to lack of new flush production; producing only 1,693,950 bbl. in October, 1,512,700 bbl. in November and 1,392,200 bbl. in December of 1935, with January, 1936, production indicating a probable further decline to 1,200,000 bbl., or a drop of 493,950 bbl., 29.1 percent, in 3 months.

Crude oil runs to stills during December, 1935, averaged about 2,750,000 bbl. per day,

or about 23,000 bbl. per day under the runs to stills during the preceding month when 2,773,000 bbl. were processed per day. Total stocks of all petroleum products declined during November, 1935, by 1,669,000 bbl. to a total of 545,186,000 bbl., indicating a daily gross withdrawal of 53,800 bbl.

While the present statistical position of the oil industry is quite satisfactory, the current rate of crude oil production and runs to stills is definitely excessive. It is feared in some quarters that the usual "new era" policy will prevail and cancel all the constructive work of the last few years. If such proves to be the case, the encouragement given producers and refiners by the January price advance may do considerable damage by encouraging continued high rate of production and runs to stills, and accelerated drilling development throughout the Southwest, particularly in the East Texas field where endless damage can be done.

Motor Fuel Demand

INDICATED domestic demand for motor fuel during November, 1935, averaged 1,199,000 bbl. per day, 10.25 percent below the daily average during the preceding month, when 1,336,000 bbl. were consumed per day; the domestic demand during November, 1935, was 31,200 bbl. above the domestic motor fuel consumption in November of 1934, an increase of 2.68 percent; 182,200 bbl. per day above the domestic motor fuel consumption in November of 1933, an increase of 17.94 percent; and 145,800 bbl. per day above the domestic motor fuel consumption in October of 1931, the peak year before 1934, an increase of 13.82 percent. Therefore during November, 1935, the domestic motor fuel consumption continued at a higher level for that month than in any preceding year; the percentage increase above November of 1934, however, dropped to 2.68, as compared with 9.86 percent increase in consumption during October of 1935 above October of 1934.

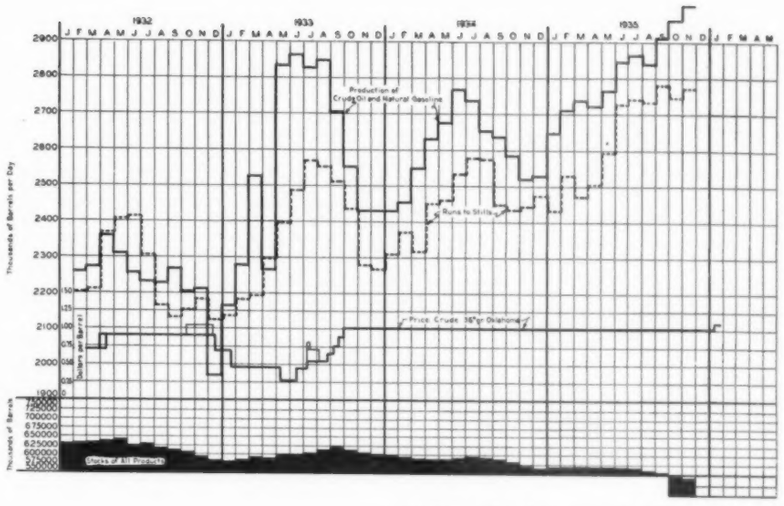
During November, 1935, 102,000 bbl. of motor fuel per day were exported from the United States, 22.52 percent above the motor fuel exports of the preceding month; 38.74 percent above motor fuel exports in November of 1934; 5.38 percent above motor fuel exports in November of 1933; but 18.8 percent below motor fuel exports in November of 1931.

On December 1, 1935, motor fuel stocks at refineries, plants, terminals and in transit, inclusive of natural gasoline, amounted to 50,212,000 bbl., an addition to storage of 1,455,000 bbl., as compared with stocks on hand on November 1, 1935, indicating that during November motor fuel supply exceeded demand by 48,450 bbl. per day. Motor fuel stocks as of December 1, 1935, were 2,540,000 bbl. in excess of stocks on hand on December 1, 1934, when they totaled 47,672,000 bbl.

Business Shows Further Improvement

THE New York Times weekly business index again advanced to higher levels, rising to 96.7 for the week ending January 4, 1936, compared with 95.6 for the week ending November 30, 1935. The New York Times index stood at 82.0 on January 1, 1936; at 77.5 on January 1, 1934; at 69.0 on January 1, 1933; at 77.0 on January 1, 1932; at 86.5 on January 1, 1931; and at 102.0 on January 1, 1930; thus indicating that the current business activity is at the highest level since the months immediately following the market crash of 1929.

An interesting development of early January, following the advance in crude oil prices, was the advance in the oil stocks on the New York Stock Exchange, as can be noted on the accompanying Exchange chart. The average of six representative oil stocks diverged appreciably from the average of 50 industrial and railroad stocks, beginning with the summer of 1934, and the oil stocks did not participate in the general advance until the end of December of 1935, when the gap began to close. It is anticipated that the normal relationship will be re-established during the coming months with the continued improvement of the oil business, and more particularly if such improvement appears to have a sound foundation.


1932
1933
1934
1935
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M
Thousands of Barrels per Day
Production of Crude Oil and Natural Gasoline
Runs to Stills
Price Crude 36° gr. Oklahoma
Dollars per Barrel
Thousands of Barrels
Stocks of All Products

U. S. production, runs to stills and price of crude oil in relation to stocks of all petroleum products.

Oil Field Developments Oklahoma

THE Oklahoma City field area was revived during the closing days of December and early in January by completion of eight large flowing wells near the State Capitol and 1½ miles due north from the former limit of production in sections 34 and 35 of T12N–R3W. The new extension will very likely develop into a small, separate, yet prolific producing area, possibly connected with the Oklahoma City field proper by structurally lower wells, which will still be above the water level but which will not compare with the Capitol sector in either initial production or recoveries per acre. The producing formation in the new extension is the "Wilcox" sand of Simpson series of Ordovician Age. British American Oil Company will be the greatest beneficiary in the Capitol sector holding some of the best acreage. The following wells have been completed to date in the new extension; all being in T12N–R3W:

Company	Well No.	Farm	Location	Sect.	Total Depth ft.	Initial Production oil-bbl.	gas-cu. ft.
British American Oil.	1	Green	SW SW SW	23	6,405	10,493	8,000,000
British American Oil.	2	Green	SW	23	6,362	19,793	
British American Oil.	1	Piersol	SE SE SE	22	6,362	27,568	34,000,000
British American Oil.	3	Piersol	NE SE SE	22	6,390	22,696	16,600,000
Superior Oil of Cal....	1	Siebley	SW	22	6,375	testing—400 bbl. per hour	
Superior Oil of Cal....	2	Siebley	NW SW SW	22	6,321	9,869	
Fairfax Oil.....	1	Bracht	SE SW SW	23	6,514	4,467 (on gas-lift)	
Fairfax Oil.....	2	Bracht	NE SW SW	23	6,500	7,194	

In addition to the four producers, the British American Oil Company is drilling six wells in the immediate vicinity. The drilling development on the north end of the Oklahoma City pool proper has been, and continues to be, quite disappointing, with all new wells requiring gas-lift and showing only 800 to 1,000 bbl. per day.

On the Centrahoma structure, the Carter Oil Company's et al No. 1 Thompson in section 34–T2N–R9E penetrated Simpson series to 6,736 ft., bailed down and tested salt water, apparently condemning this structure. Centrahoma prospect was found on the basis of surface work and was subsequently checked with seismographs with excellent results, causing one of the most active trading booms

Effect of Bureau of Mines Recommendations in Principal Oil Producing States

	December 1935				Jan. 1936		
	Production bbl.	Percent of Total U. S. Production	Bureau of Mines Quota bbl.	Over-production bbl.	Bureau of Mines Quota bbl.	Daily Average Production week ending Jan. 4 bbl.	Daily Average Production week ending Jan. 11 bbl.
Texas	33,416,206	37.9	31,179,800	2,236,406	1,017,200	1,078,500	1,042,000
California	21,132,250	23.9	15,927,800	5,204,450	517,800	670,000	682,500
Oklahoma	14,919,475	16.9	14,883,100	36,375	481,000	463,000	487,000
Louisiana	5,130,173	5.8	3,968,000	1,162,173	132,600	169,000	175,500
Kansas	4,451,525	5.1	4,299,700	151,825	134,000	137,500	143,500
Total United States	88,117,595	100.0	78,746,200	9,371,395	2,559,200	2,806,000	2,819,000

Oklahoma ever witnessed with lease and royalty prices commanding unusually high prices for a wildcat prospect. It is probable that in the Fitts area the commercial saturation of the Simpson series is closely related to the south fault zone of the Franks Graben, and that in the basin, away from the fault, conditions are not as favorable for production.

Gulf Export Prices for Major Oil Products

Products		Cents per Gallon			
		Dec. 30	Jan. 8	Jan. 15	Jan. 22
Gasoline:	U. S. Motor	5⅜	5⅜	5½	5½
	64/66–375 E.P.	5¾	5¾	5¾	5¾
	59 Oct. & below	5⅜	5⅜	5⅜	5⅜
	65 Oct. & above	5⅝	5⅝	5⅝	5⅞
Aviation Gasoline:	73 Oct. & above	9½	9½	9½	9½
Kerosene:	44 w.w.	4¼	4¼	4¼	4¼
	41–43 w.w.	4	4	4	4
	41–43 p.w.	3⅞	3⅞	3⅞	3⅞
Gasoil:	26–30 translusc.	3⅛	3⅛	3⅛	3⅛
	30 plus translusc.	3¼	3¼	3¼	3¼
Fuel oil:	Bunker purposes (per bbl.)	$ .90	$ .90	$ .90	$ .90
Grade C:	Cargo lots (per bbl.)	$ .70	$ .70	$ .70	$ .70
	Diesel oil (per bbl.)	$1.50	$1.50	$1.50	$1.50
Lubricating Oil:	Bright Stock No. 8	26	26	26	26
(New York Export	Bright Stock No. 6½	25½	25½	25½	25½
Market)	Warren E.	20	20	20	20
	600 Unfilt.	16½	16½	16½	16½
	650 Unfilt.	18	18	18	18
	600 Flash s.r.	19	19	19	19
	650 Flash s.r.	24	24	24	24
	Neutral 200 No. 3	29½	29½	29¼	29½
	Neutral 150 No. 3½	25	25	25	25
So. Texas:	Red oil 300 No. 5–6	7¼	7¼	7¼	7¼
	750	9	9	9	9
	1200	9½	9½	9½	9½
	Pale oil 500	7⅞	7⅞	7⅞	7⅞
	750	9	9	9	9
	1200	9½	9½	9½	9½
Crude Oil:	East Texas crude delivered at Gulf port for Export	$1.21½	$1.21½	$1.21½	$1.21½
	Venezuela crude	.83	.83	.83	.83
	Trinidad crude	.85	.85	.85	.85
	Panuco crude	.90	.90	.90	.90

Freight Rates

	Dec. 30		Jan. 8		Jan. 15		Jan. 22	
	Dirty	Clean	Dirty	Clean	Dirty	Clean	Dirty	Clean
(Shillings per ton)								
Calif.—U.K. or Continent	14/–	15/–	14/–	15/–	14/–	15/–	14/–	15/–
Gulf—U.K. or Continent	13/–	14/6	14/–	14/6	14/–	14/6	14/–	14/–
(Cents per barrel)								
Calif.—North Atlantic	46	32	60	55	60	70	60	75
Gulf—North Atlantic	30	32	32	32	32	33	33	34
Venezuela—N. Hatteras	18	—	18	—	18	—	23	—
Tampico—N. Hatteras	25	—	25	—	25	—	25	—

Rodessa, Louisiana

RODESSA field in Caddo parish in the northwest corner of Louisiana was extended during the past month ½ mile to the west and into Cass County, Texas, by R. W. Norton. His No. 1 Haywood in Priscilla Evans survey was completed for 1,100 bbl. per day initially through ½-inch choke from 6,002 ft. in the Öolitic limestone. American Liberty Oil Company's No. 1 J. B. Rodgers, two miles further west from R. W. Norton's extensioner, in C. M. Robinson survey (also in Cass County) failed to extend the field, testing salt water from 6,047 to 6,051 ft. in the Öolitic limestone; thus indicating that the Rodessa field either narrows down in Texas or gradually plays out. Another important failure was abandoned in Miller County, Arkansas, 3½ miles north from Rodessa field. It was Haynes Oil Corporation's No. 1 Embree in section 9–T20S–R28W which drilled to 6,514 ft. More favorable results were obtained on the east side where Bartex Pipe Line Company's (Phillips Petroleum) No. 1 B. H. Norton in section 18–T23N–R16W was completed for 720 bbl. per day initially through ⅛-inch choke from a total depth of 6,029 ft. in the Öolitic limestone, extending the field one mile to the northeast.

Rodessa field at this writing covers some 4,160 acres and has 53 completed oil wells, which are allowed to produce currently 600 bbl. per day each, or 31,800 bbl. altogether. Some 50 locations are active in the field and the number of completions should reach 70 early in February.

BASIL B. ZAVOICO

▼

Peruvian Oil, 1934

FINAL official statistics for the year 1934 show that the total production of oil in Peru during that year was 16,314,381 bbl. of crude. This is an all-time record, being 3,057,063 bbl. over 1933. The production of natural gasoline also established a record, amounting to 1,221,004 bbl., an increase of 152,260 bbl. over 1933.

Exportation of crude oil in 1933 was 1,351,312 bbl., most of it being shipped from the port of Talara. There were also exported 389,359 tons of gasoline, 124,677 tons fuel oil, 38,743 tons kerosene, 71,248 tons gas oil and 1,037 tons lubricating oil.

The principal producer was the International Petroleum Company (La Brea and Parinas fields) which obtained 86.82 percent of the total. The Cia. Petrolera Lobitos (Lobitos field) is credited with 12.89 percent, leaving 0.29 percent for the company operating in the Zorritos field.

The number of producing wells in 1934 was 2,463; 51 new wells were drilled, of which 46 were producers. The average yield of all fields to date has been 2,445 bbl. per acre. The available reserves are estimated at 1,308,692,462 bbl.

MEXICO

CIA. PETROLEOS DE MEXICO, S. A. (PETROMEX) announces the launching of an ambitious program which includes the drilling of several wells in lands of the national petroleum reserves. These reserves were obtained from the federal government as part payment for the administration's stock in the company. Among these wells is Petromex No. 5, which is being sunk in the prosperous Poza Rica field, Vera Cruz state. When this well is completed next May, Petromex anticipates a daily production of at least 7,000 bbl. from wells under its control. Oil obtained from No. 5 and other wells being drilled in the Panuco and Isthmus of Tehauntepec zones, Vera Cruz, will place it in a position to supply all requirements of the National Railways of Mexico and various national government departments, estimates Petromex.

Petromex has enlarged its Tampico refinery and expects that by late January the plant will be able to treat daily 3,000 bbl. of light crude from the Tuxpan zone and 1,000 bbl. of heavy crude from the Panuco fields. Contract for a cracking plant at this refinery, for production of higher grade gasoline, has been granted to an American firm. Daily extraction of 600 bbl. quality asphalt is expected from the daily run of 1,000 bbl. Panuco crude. The asphalt is to be supplied to the Ministry of Communications and Public Works, for use on national trunk highways.

After completion of the wells in Poza Rica and other Vera Cruz zones, Petromex plans to build a pipeline from these fields to a proposed refinery in Mexico City, which will supply nearby markets. Work on this refinery is expected to start in June or July. Petromex has entered the Mexico City market in competition with private companies with the sale of gasoline and lubricants. It has established filing stations and is using extensive newspaper advertising.

Federal oil reserves were increased 1,063,608 hectareas (a hectarea is 2.47104 acres) in 1935, President Lazaro Cardenas announced in his New Year's message.

A new official interpretation of article one of federal constitutional clause 27, governing the holding of property in Mexico, was made by the Ministry of Foreign Relations. The general principle is thereby established that only Mexicans by birth or naturalization, or members of Mexican societies, can gain dominion over lands, waters and their accessories; foreigners are forbidden under any circumstances to hold lands in zones 100 kilometers (62 miles) from international frontiers or 50 kilometers (31 miles) from the seacoasts, or to be members of societies holding lands in these zones; foreigners can hold exploitation rights to mines, subsoil and mineral combustible deposits only by constituting themselves members of Mexican societies, functioning in accord with Mexican laws; such aliens must not seek the protection of their governments in matters concerning their concessions.

Famous "Faja de Oro" (Golden Lane) zone of Vera Cruz has been expanded with the bringing in of two wells of unspecified production, Ministry of National Economy announces. One well is Cerro Viejo No. 70, which began production at 1,947 ft. The other is Cacalilao No. 352 in which oil was encountered at 1,743 ft.

What is understood to be the first of a series of newspaper advertisements protesting the price of ten centavos (about 2.80 cents) per liter that the Mexican government fixed for gasoline has appeared in Mexico City papers. The advertisement, inserted by the four major companies producing and distributing gasoline in Mexico—Mexican Eagle Oil Co., Huasteca Petroleum Co. (Standard of New Jersey), Pierce Oil Co., S. A. and California Standard Oil Co. of Mexico—asserts that Mexico's gasoline price is lower than that of 19 other countries, including the United States, and asks:

"If the producing and refining companies are obliged to sell gasoline at such a low price, compared with that of other countries, will it be possible for them to improve or maintain their standard of quality, service and ample distribution?"

DOUGLAS GRAHAME

CANADA

Imports

IMPORTS of crude into Canada during November, 1935, amounted to 137,399,424 gallons valued at $3,986,691, compared with 124,044,284 gallons for November 1934, valued at $3.491,463. Countries of origin for November, 1935, were as follows:

	Gallons	Dollars
United States	90,557,834	2,711,684
Colombia	19,750,390	572,199
Peru	15,803,797	503,897
Venezuela	11,287,403	198,911

Gasoline imports totalled 1,400,119 gallons in November, 1935, valued at $118,381. This showed a decrease from November, 1934, figures for which were 1,623,317 gallons valued at $137,487. It was also a considerable decrease from the October 1935 figures of 2,082,373 gallons valued at $164,843.

Miscellaneous

IMPORTS of crude to Montreal during the navigation season of 1935 amounted to 1,904,229 tons, compared with 1,856,464 tons during the 1934 season. This represented an increase of 47,765 tons.

From Calgary comes the news that a new crude oil field covering thousands of acres in southern Alberta has been indicated by the Terminal well on the Del Bonita structure. The well is flowing at 100 bbl. daily, and is a commercial producer rated at 34 deg. Baume and accompanied by 5,000,000 cubic feet of gas per day. Production was obtained at 5,083 ft., a short distance in the limestone.

In the Turner Valley, the British American Oil Company has started the construction of a $300,000 absorption plant. British Dominion in Turner Valley is producing 200 bbl. daily, and drilling in the limestone is being continued. Union Freehold may strike production at any time, and the well is at present drilling in the limestone.

Oil Production Figures

IN ALBERTA the Petroleum and Natural Gas Division of the Department of Lands and Mines announced that the production for the eleven months of 1935, ending November, was 1,153,632 bbl., of which the Turner Valley contributed 1,119,385 bbl. Red Coulee produced 19,063 bbl.; Wainwright 13,620 bbl.; and Skiff 1,564 bbl.

During the month of November, the Turner Valley produced 100,751 bbl. of naphtha and 1,264 bbl. of light crude; Red Coulee 1,459 bbl. of light crude; and Wainwright 478 bbl. of heavy crude oil.

R. C. ROWE

SHIPPING

BECAUSE of her several special features, the COMANCHEE will undoubtedly prove one of the outstanding tankships of the year, and her performance after running trials next March will be watched with interest in both oil company and marine circles. She is the largest ship ever laid down in Great Britain for the transport of lubricants in bulk, and she will have a loaded speed of 13 knots, in line with the modern tendency for higher speed and quicker turnround. Unlike the conventional tanker, she has a deep double-bottom tank, which dispenses with the necessity of carrying water ballast in the cargo compartments during outward voyages. While this involves a certain loss of cargo capacity it will prevent contamination of the various grades of lubricating oils in the 27 cargo tanks that have been formed by the dual longitudinal and by the usual transverse bulkheads.

The ship was launched at Clydebank, Scotland on January 9 and christened by Mrs. Fredrick J. Wolfe, wife of the chairman of Anglo-American for which company the tanker was built.

Construction was under Sir Joseph Isherwood's longitudinal system and her builders were John Brown, Ltd., Glasgow. She has a cargo capacity of 2,500,000 Imp. gal., a loaded speed of 13 knots and is 445 x 61 x 32 ft. She is Diesel powered, and the engine driving her single screw consists of a four-cylinder, opposed-piston, Brown-Doxford, two-stroke unit, 620 mm. diameter by 2,320 stroke.

Despite the careful construction work essential with the building of a tanker, her builders have made excellent progress with the work, and although only ordered in June last, it will be possible to run her sea trials during March next. The hull of the vessel has been built under special survey to the highest class of Lloyd's Register of Shipping, and the special design involved about 700 more tons of steel than the average tanker of her size. Her accommodation is of the most modern standard for this class of vessel, fully meeting the requirements of the Board of Trade. The vessel also complies with the latest regulations of the Panama Canal authorities, while the usual navigational equipment is augmented by the provision of gyro compasses and a gyro pilot for automatic steering, and a radio direction-finder.

There are two separate cargo pump rooms, accommodating eight independent pumps. Fullest facilities exist for keeping various grades of oil isolated, and elaborate arrangements are made to provide separate pipe systems, and so avoid contamination of one grade by another. In certain of the tanks piping is provided for heating the oil to the desirable temperature for pumping. An auxiliary boiler of the single-ended type is installed, together with a thimble-tube boiler for utilising the heat of the exhaust gases from the main engine.

JAPAN will build four more high speed motor-tankers during 1936. These will follow closely in design the two 18-knot, 10,000 ton tankers built during 1935, and will increase their fleet of fast oil carriers to eight.

Mitsui & Company, Ltd. will build two, one of which, the OTAWA SAN MARU, will be completed in April and will make her maiden voyage to California in May. The second, and as yet unnamed, tanker will be finished shortly after. The early date of completion is taken as indication that this program was determined upon and construction started during 1935.

Kawasaki Steamship Company, which already has one of these high speed tankers, will build another at its own yards at Kawasaki, Japan.

The TATEKAWA MARU, built last year at the Kawasaki yards for their own company, has been reported by the U. S. Department of Commerce as making 22 knots on its trial run. Japanese shipping men, however, say that this is too much and that she probably made about 19 knots, as did the TOA MARU built for the Iino interests. Kawasaki will operate its tankers between Japan and California, carrying raw silk in the dry hold forward on the East bound trip, returning with crude oil.

The fourth will, it is understood, also be built at the Kawasaki yards, but is for the Yamashita Steamship and Mining Company.

According to the Pacific Coast representative of Mitsui & Company, their tankers will be powered with eight cylinder, 8,000 h.p. Mitsui-Burmeister Wayne Diesel engines. Tankers built at the Kawasaki yards will be equipped with double acting two cycle, eight-cylinder airless-injection engines of the Kawasaki-M.A.N. type.

The two fast motor tankers completed last year, the KYOKUTO MARU and TOA MARU, were built at the Kawasaki yards for Iino Shoji Kaisha and are now in use. In speaking of their performance and in justification of continuation of their high speed tanker program, Japanese shipping officials say that although these motorships are not operated at peak speeds on commercial service, it is possible for them to make ten complete round trips between California and Japanese ports in a year. The best that can be accomplished with the ordinary 10 to 12 knot old style steam tankers is five to six round trips. Six is the exception, only obtainable under best conditions. While detailed figures were not submitted, it was inferred that operating costs on one of these fast tankers, including interest on the additional investment, compares favorably with that of the cost of two slower steam tankers necessary to provide equivalent service.

All of the fleet conform to a standard design which is conventional in appearance save for the clipper bow, enabling them to ride high in rough weather. Their speed ranges from 17½ knots for the TEIYO MARU to 19.1 knots developed on trial by the TOA MARU last year. Whether any of the four now building can equal this remains to be seen but their specifications call for a minimum of 18 knots. Instead of the midship-bulkhead, there are two continuous bulkheads reaching to the upper deck, extending the full length of the tank section. Cargo tanks occupy midship section as in the conventional design, with machinery aft and a dry hold forward. For convenience in carrying light and heavy oil, the tanks are separated into forward and aft groups and there are two tanks for gasoline—one on each side of the forward section.

While the normal output of these engines is 8,000 h.p. at 110 r.p.m., the TOA MARU on her trial trip developed 8,591 h.p. Electric power is provided by three generators installed in the engine room driven by four cylinder Diesel engines of 445 h.p. at 375 r.p.m. There is also an emergency Diesel engined dynamo developing 40 h.p. at 450 r.p.m.

To provide steam for heating heavy oil, driving cargo pumps and other purposes, two oil-fired and one exhaust gas heated boilers are provided. Other auxiliary boiler room equipment includes two centrifugal sea water pumps, two fuel oil transfer pumps, two fuel oil service pumps, a cooling water pump, and a fire pump. A fresh-water cooling system is provided, oil being mixed with the water to prevent rust. Two electrically operated centrifugal pumps, each driven by a 95 h.p. 220 volt motor at 1,150 to 1,300 r.p.m. provide for circulation in this system.

There are two rotary gear type lubricating pumps, each driven by a 40 h.p. motor at 1,000 r.p.m.

To insure rapid handling of cargo each tanker is equipped with four high pressure booster pumps, each with a capacity of 2,100 bbl. per hour.

Dimensions of the standard type Japanese motor-tankers:

Length b.p.	500 ft.
Width	65 "
Depth	37 "
Draught loaded	26 to 29 ft.
Gross (D/W)	13,500 tons
Net	10,000 "
Speed	18 knots
Engines	Diesel 8-cylinder 8,000 h.p.
Lloyds rating	100-A-1L.M.C.
Cargo capacity	12,000 tons

THE SAN RAMON MARU, built last year for Mitsubishi Shoji Kaisha, a 11,000 ton D/W tanker of 14½ knots, made her maiden voyage to San Pedro, California in December. Even this 445 ft. Diesel-driven motor-tanker is faster than any oil carrier owned on this side of the Pacific.

World Petroleum Abstracts

Summaries of the Most Important Articles as Published in the Oil Press of the World Dealing With Technical and Economic Aspects of the Industry. *Edited by Dr. O. W. Willcox*

Petroleum Geology

Work of the Schlumberger Brothers in the Domain of Geophysics.—Anon., in REV. PETROLIFERE, No. 660 (1935), pp. 1559–1609.

The entire issue of this French Journal (Dec. 7) is devoted to the subject of prospecting for oil by physical methods, mostly the electrical method developed and operated by C. and M. Schlumberger. Among the subjects treated are: Note on the history of geophysics, Considerations on geophysics, The electrical surveying of wells, Geophysical methods of prospecting, Geophysics in the world, Geophysics at the International Congress of Mines, Metallurgy and Applied Geology (Paris 1935). The work is a fair summary of the different aspects of the electrical surveying method.

Measurements with the New Static Gravimeter of the Geodetic Institute.—H. Haalck in OEL UND KOHLE, vol. 11 (1935), No. 43, pp. 851–853.

The simplified gravimeter devised by the author appears to have reduced the operation of a gravimetric survey to very simple terms. Four instruments are mounted in opposite pairs in an auto truck, so that two observers, who need have no special training, can make four independent readings. The truck stops at a point, the altitude of which is known; the instruments are released, the readings taken and the truck moves to the next point. The time consumed per stop is about four minutes except when high winds are blowing; in such case a wind break must be set up, but this is not necessary with a heavy truck. Two measurements are taken at each point, one on the out trip and another on the return. With points spaced one kilometer apart, some 27 measurements may be made in a day of 7½ hours. The standard error is plus or minus one mgal. This is a high degree of accuracy, and has served to locate even small salt domes.

Drilling

Relationship of Mud to Electrical Coring.—H. C. H. Thomas, in JOUR. INST. PETROL. TECHNOLOGISTS, vol. 21 (1935), No. 143, pp. 776–789.

This paper demonstrates that no comparable specific factor for any formation can be established by electrical logging without taking into consideration the nature of the drilling mud. Mud is shown to have considerable effect on the resistivity log. This is due to the fact that the mud or its constituents may penetrate the formations and thus by its own conductivity alter the picture. In the author's view it is impossible to assign a numerical production value to a single sand or group of sands in a single well based on the specific resistivity. On the other hand, if a series of wells be drilled to the same sand under similar conditions of mud, hydrostatic pressure, depth and time, a reasonably good forecast can be made on the basis of results from the group.

Viscosity and Stability of Drilling Mud.—C. W. Woolgar, in JOUR. INST. PETROL. TECHNOLOGISTS, vol. 21 (1935), No. 144, pp. 825–837.

The viscosity and stability of some drilling muds have been studied, and it is shown that yield point and viscosity must be differentiated and that yield point is the important criterion of a mud.

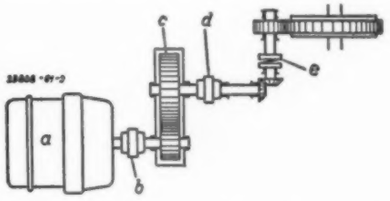
The density of the bottom portions of a settled mud were found to be independent of the length and diameter of the column, and therefore the stability of a mud is not so important as has hitherto been supposed.

The calibration and use of a Stormer viscometer are also described.

The yield point, and not the viscosity, governs such important properties as suitability of the mud for pumping, its ability to hold cuttings suspended and prevent them from clogging the bit if pumping ceases, its plastering and sealing-off effects, its ability to hold non-colloidal weighting material permanently in suspension, and its stability, by which is meant that a mud with an appreciable yield point will settle very slowly. It is therefore concluded that the only measurement that is necessary to be made on a mud, apart from its density, is of the yield point, either directly by means of a shearometer or by the viscosity at 600 r.p.m. and a knowledge of the viscosity/yield point relationship. The author thinks that in many cases far too thin a mud is used for drilling.

New German Drilling Rig.—Rathje, in PETROLEUM, vol. 31 (1935), No. 43, pp. 1–5.

The German Demag concern has designed and built a rotary rig which is claimed to be an improvement over the American model. The principal difference is the substitution of a high precision gear drive for the rotary table, instead of the chain drive said to be prevalent in American practice. The chief objection to the chain drive is the high peripheral velocity and excessive wear, not to mention the noise. A well designed gear drive is practically noiseless and practically unbreakable; it will also be only slightly subject to wear. Objections have been that the gear drive is too rigid and does not take up shocks like a chain drive. However, this ability of a chain drive to absorb shock is over rated, and the rigidity of gears can be overcome by a suitable elastic coupling. The rotary table is provided with a special 50 or 60 h.p. motor; the pump and the draw works have their own power. The Demag



rotary drive is represented in the accompanying sketch; *b* and *d* are two elastic joints, the latter taking the form of an adjustable clutch that gives when a certain torque is exceeded. This is provided as a protection against twist-offs which might occur in a fatigued drill stem.

One of the advantages of this direct drive is a considerable saving of space under the derrick.

Cementing Problems in the Pechelbronn Field of France.—J. Hontcharenko, in OIL WEEKLY, vol. 79 (1935), No. 8, p. 39.

Conditions in the Pechelbronn area of France that call for application of rather different cementing technique are that many of the wells have to be drilled through a dozen or more sands before reaching the principal oil producing horizon, and that various salt water sands are separated from oil horizons by very thin strata, and that in many instances an oil sand seems to be literally sandwiched into the middle of water sand. With subsurface conditions such as these, every cementing job must contemplate shutting off water both from above and below the producing horizons.

These problems are complicated by the presence of very high temperatures, which increase by 1° F. for every 20 ft. of depth. This forces the use of different qualities of cement for different depths, and a close observance of minimum time in pumping the cement into the hole.

Oil Well Operation

Retarding Corrosion of Well Equipment by Chemical Treatment.—L. G. E. Bignell, in OIL & GAS JOUR., vol. 34 (1935), No. 20, pp. 32–25.

Corrosion of iron and steel equipment in oil wells and destruction of surface equipment handling oils and waters containing sulphur compounds has been common in many oil

fields. With oil fields in western Kansas completed in lime formations it has been noted that corrosion of equipment has been relatively rapid and steps have been taken to combat this condition.

Instead of handling the well production through the usual type bolted steel tanks, many operators in the western Kansas fields have resorted to the use of wooden tanks. These tanks are provided with tight decks and equipped with pressure gauges and relief valves so evaporation is held to a minimum. In some instances only treating tanks have been made of wood and after the water has been removed the oil has been handled in the usual type bolted steel tanks. For lead lines between well head and tanks or separators some companies are using composition pipe containing no iron or steel. This pipe is made of an asbestos base compound and is now available for relatively high working pressures. Cement lined pipe is also being used for this purpose.

Aside from corrosion of surface equipment, the destruction of equipment in the well has caused serious trouble. This refers not only to the action of sulphur on metal parts, but also to the effects of various salts in the well water that deposit scale on the piping and moving parts of pumps. These are chiefly lime, strontium and barium salts. To prevent the formation of such scale requires treating the well with a variety of chemical reagents. Sodium cresylate solution has been found better than caustic soda for counteracting acidity and in preventing scale formation. Another useful reagent for the same purpose is an alkaline solution of tannic acid derived from various barks; also solutions of sodium aluminate or silicate. In some cases sodium sulphate is used as an anti-incrustant. The best treatment will naturally vary from well to well, and one large company has found it advisable to invest in a special compounding plant where oil well waters are analyzed and a suitable chemical treatment is prepared.

Water-Flooding in the Mid-Continent.—Geo. H. Fancher and Kenneth B. Barnes, before Petrol. Div., Am. M. & M. Engineers, Houston, 1935.

The first systematic flood in the Mid-Continent was started in 1931 in Rogers County, Oklahoma, in the south end of the Alluwe field, in the Bartlesville sand. Development is being continued in this and other parts of the Nowata field at the present time. Other fields in the Mid-Continent are in Creek County, Oklahoma, in the Red Fork sand; Osage County, Oklahoma, in the Bartlesville sand; Chautauqua County, Kansas, in the Peru sand; and Greenwood County, Kansas, in the Bartlesville sand.

Flooding is resorted to mainly with oil sands that lack a natural water drive and where gas pressures are weak to an extent that the gas bubbles occurring in the capillary net works of oil sands are actually a deterrent or obstruction to the movement of the oil to the well. Gas bubbles must be distorted to pass through the reoccurring small openings, and energy must be supplied to perform the distortion. In natural production, gas bubbles further back in the sand and under higher pressure, by their expansion supply the needed energy. As reservoir pressure decreases, a stagnant, greatly enlarged system of bubbles develops which resists flow. The supplial of energy through the medium of water affords convenient and economical means for overcoming the stagnation of the system, and for pushing the gas bubbles through the capillary net work.

The basis of all successful flooding projects is thorough coring of the formations and a careful laboratory study of the cores. It is emphasized that the water-flooding of oil-sands is not fool-proof. A proposed flood should be carefully studied and planned. The systematic water-floods now in progress in the Mid-Continent were initiated only after detailed study of the condition of the sands had been made. This practice should be continued. If not, enthusiasm for a process promising profits will produce failures resulting in premature condemnation of it.

Multiple-Diaphragm Recording Pressure Gage.—W. B. Berwald, H. A. Buss and C. E. Reistle, in BUR. MINES, RPT. OF INVESTIGATIONS, No. 3291 (1935).

Accurate measurement of subsurface pressures and temperatures in producing oil and gas wells is one of the most important steps ever taken to place the practice of petroleum production on an exact scientific basis. Pressures and temperatures in a petroleum reservoir have a marked influence over the movement of oil and gas both within the reservoir and through the various-size "flow strings" of producing wells to the surface. Knowledge of these factors forms a basis for any attempt to apply scientific methods to the solution or analysis of many problems encountered in the production of oil and gas. Without accurate measurements of pressures and temperatures within the reservoir and well "flow strings" the application of many proved engineering and scientific principles is only approximation. This paper presents briefly the part the Bureau of Mines has played in the development of suitable instruments for these measurements and gives in detail, largely through drawings, the design, construction and operation of a new recording subsurface pressure gage which has been in use during the past year by Bureau engineers.

The gage here recommended by the Bureau of Mines is described with the aid of no less than 60 drawings, showing the construction and operation to the last detail.

Problem of Oil Treating.—W. B. Leach, in OIL & GAS JOUR., vol. 34 (1935), No. 30, pp. 25–30.

The oil treatment here considered relates to handling of the emulsion problem. Due to the fact that modern air and gas lifting methods are productive of oil-water emulsions, while requirements of pipeline companies and refineries regarding water content of crude oil are stringent, the producer must exert himself to keep the water content below one percent and in some cases below one-half of one percent. The three methods of "breaking" emulsions are mechanical, electrical and chemical. The only mechanical method that could come into consideration is centrifugaling, which is expensive and is now obsolete. In the electrical method the emulsion is contacted with a high voltage electrical charge; this method is successful and economical in some California and Gulf coast fields, or in fields producing asphalt base crudes; Mid-continent crudes of paraffine and naphthene base are not as responsive to electrical treatment. Chemical treatment is the commoner practice and involves the use of various types of demulsifying agents that disrupt the film of oil surrounding the water globule, thus setting free the water. Different oils require different treatment, hence emulsion breaking is properly the work of a specialist where gravity separation alone is not sufficient.

Prevention is better than cure. It may happen that one well in bad repair may produce an emulsion that will contaminate the entire production of a property. In the final analysis, pulling and reconditioning such a well may be the cheapest disposal of the treating problem.

Pipelines

Cement Coating of Pipe.—John C. Albright in OIL WEEKLY, vol. 79 (1935), No. 8, pp. 17–27.

This article describes the practice of the National Transit Co., which has been cementing pipeline exteriors against external corrosion for many years in Pennsylvania with satisfactory results, especially where sulphurous shales, refinery waste waters and salty brines are encountered. A great deal of experimenting was necessary before a satisfactory method was evolved. The technique finally adopted is to support the pipe in a form made of sheet iron in the ditch, then pour cement around the pipe, and back fill. The chief difficulty is to support the forms so that the line will not be subjected to sagging and cracking of the cement.

Flow of Natural Gas Through High-Pressure Transmission Lines.—I. W. Johnson and W. B. Berwald, in BUREAU OF MINES MONOGRAPH 6 (1935).

This bulletin includes a listing of pipeline formulas used by different investigators; a discussion of flow tests made by the writers on commercial and experimental pipelines, including methods of testing and of analyzing flow data; and a discussion of the application of flow data to commercial pipeline transmission problems. Detailed mathematical development of formulas is included in appendixes with appropriate references in the main text of the bulletin.

Flow tests have been made of 29 pipelines totaling 757 miles of pipe of 6 to 22 inches in diameter under operating pressures of 30 to 600 lbs. per sq. inch. In the larger-diameter lines, free from condensates and foreign materials, delivery corresponds more closely to Weymouth's formula than to any other.

A special series of tests of a small experimental pipeline was made to determine the relative delivery capacities of a pipeline when the gas was flowing in the direction of increased diameters of pipe and when the direction of flow was toward reduced diameters. The results indicate that under the conditions of the tests, and for the same pressure conditions, the rate of flow with increasing pipe diameters was slightly greater than that toward decreasing pipe diameters. This difference probably can be attributed to the effect of the swages in the experimental pipeline.

The paralleling of sections of existing pipeline systems is one important method of

increasing the delivery capacities of the systems. Several formulas have been developed in this bulletin to aid in the design of such systems.

In several pipelines tested the rate of flow was unsteady, indicating additional storage of gas or drainage of stored gas from the lines. The flow formulas are not applicable to unsteady flow conditions. As was to be expected, the tests of commercial pipelines showed that the rate of gas withdrawal from a line is greater when the mean line pressure is decreasing than when it is constant and that the rate of gas withdrawal is less when the mean line pressure is increasing.

NEW METHOD OF THROWING A PIPELINE ACROSS A RIVER.—E. F. Schmidt, in PIPE LINE NEWS, vol. 7 (1935), No. 7, p. 7.

A description is given of a new method of carrying a 20-inch pipeline across a river, where conditions did not warrant the erection of a bridge. The usual practice has been to use manifold lines. A header would be built on either side of the river well up in the bank and a number of smaller lines extended from header to header across the bed of the stream. The banks of the Trinity are reasonably permanent and a good foundation could be had in the bed of the stream.

It was therefore decided to run the 20-inch line continuously under the bed of the river. The banks on either side were excavated to a gradual slope from the bed of the stream to the top of the bank well back from the original bank and a channel was dug thru the bed of the stream to permit the pipeline to have about four feet covering from the top of the line to the original bed of the stream. A profile of the finished ditch was made for the entire length of the river crossing from the top of the bank on one side through the excavated bed of the stream to the top bank on the opposite side. The 20-inch pipe was then shaped to the profile by making the bends at proper locations and the pipe for the entire river crossing was suspended over the stream above the water in such a position that it could be properly coated.

Special clamps were attached at each weld as a precaution against fracture and sufficient weight was added to overcome buoyancy and after coating the pipe was lowered into the prepared trench, which it fitted almost perfectly.

MEASURING EFFECTIVENESS OF PIPE LINE COATING.—Anon., in OIL & GAS JOUR., vol. 34 (1935), No. 29, p. 45.

An electrical device for determining the condition of coatings on buried pipelines without the necessity of uncovering the pipe has been undergoing a series of tests on sections of several lines on the Gulf Coast. It was invented and developed by A. L. Smith who, in conjunction with Crutcher-Rolfs-Cummings, Inc., has been conducting the tests. Results of the tests have been marked with success, and various uses for the device other than checking coating faults have been indicated.

The device includes a high frequency transmitter, and a receiving instrument for measuring electrical flux density. The transmitter, one terminal of which contacts the pipe and the other connects with a ground rod located some distance to the side of the line, charges the pipe. The receiving instrument, which is light and portable, is carried along the line and, through a ground contact made at desired intervals, reacts to current discharges from the pipe in proportion to the current density in the soil around the pipe.

Density of the current flux at any point is directly dependent on the insulating effectiveness of the coating, the presence of holidays and the distance from the point of transmitter contact. The receiving instrument covers a wide range of sensitivity through variable steps to detect the slightest changes in flux density. As there can be no standard, all readings on a line are relative.

The instrument is adapted to various uses. Corrosive areas along a proposed pipeline may be detected. It will disclose the condition of the pipe coating and give an indication of the amount of current required to protect the line when cathodic protection is to be applied. It is also used to determine the point of ground beds to obtain the utmost distribution of current. Oil leaks, or "collar sweats" not visible on the surface can easily be detected, as readings run relatively high the instant the instrument engages the soil above these oil-saturated areas.

Petroleum Refining

CONTINUOUS COKING AT A DUBBS PLANT.—S. F. K. van Dongen and W. A. Keightly in PETROLEUM, vol. 31 (1935), No. 38, pp. 1–2.

A description is given of the coking arrangements at a Roumanian refinery. The continuity of the coking process is assured by providing two sets of coking stills, of which one is in operation while the other is being emptied and cleaned. Low pressure coking is practiced; this is easier to control and carry out than high pressure coking, and there is no sacrifice of quality or quantity of either coke or distillate.

SWEETENING WITH PLUMBITE.—C. W. Berger, in REFINER, vol. 14 (1935), No. 10, pp. 470–472.

Doctor sweetening of gasolines is one of those empirical arts full of real or supposed secrets that are jealously guarded by men experienced in this branch of refining. As in many other similar arts the magic of the "practical" man is giving place to rational methods based on a fuller understanding of the principles involved, which the author here explains in detail. It all comes down to a matter of the properties and reactions of mercaptans and other sulphur compounds found in petroleum, and the methods of determining their respective quantities. The rub comes in obtaining necessary information in the shortest possible time. Careful control of the use of free sulphur in doctor treating is most important, for which the following short and accurate method is supplied:

Filter about one half-inch of the gasoline into a four-ounce bottle and add the same amount of clear doctor solution. Add one cc. of ethyl mercaptan solution and shake vigorously. If the gasoline is non-corrosive, particles of free sulphur will be seen floating about on top of the doctor. If the gasoline is "off strip", a dark brown or black discoloration will be formed. This test is as easy to make as a doctor test and differs from it only in that ethyl mercaptan is used instead of a pinch of sulphur.

In making up the mercaptan solution, add 1cc. of ethyl mercaptan to 100cc. of non-corrosive gasoline. It is best to shake this gasoline with a little metallic mercury and filter and weather it to be certain that it is absolutely non-corrosive and not too volatile, before adding the ethyl mercaptan.

Next in importance to sulphur control comes doctor solution control. It is absolutely necessary to have good, clean, strong doctor solution for satisfactory treating results. The condition of the doctor solution can best be handled by the laboratory, and advice as to additions of more litharge and caustic soda should be forthcoming daily. The treater usually can tell when his doctor solution is getting weak in his treater, and can often save himself severe emulsion troubles by drawing it off before it is entirely spent.

COSTING OF PETROLEUM REFINERY OPERATIONS.—Gordon Kerr, in JOUR. INST. PETROLEUM TECHNOLOGISTS, vol. 21 (1935), No. 145, pp. 907–918.

The paper outlines the principles to be followed in arriving at "Process Costs" for the various refinery operations. These costs are intended as a guide to those responsible for the operations, and the preparation calls for joint consideration by chemist, engineer and accountant.

The distinction between Direct Costs, which would cease in the event of a particular operation being discontinued, and Indirect Costs, should always be maintained, and must be borne in mind both in the first segregation of wages, materials and other expenditure, and in determining which processes can be costed separately.

The main classes of expenditure: Direct Costs, Auxiliaries, Fixed Charges and Depreciation, are reviewed, and the method of combining these to show the total costs of each process is indicated. A form of cost statement is suggested.

RECOVERY OF BY-PRODUCTS FROM THE DOCTOR CYCLE.—Kenneth S. Valentine and Gordon MacLean, in REFINER, vol. 14 (1935), No. 10, pp. 475–478.

Doctor sweetening has long been considered a necessity, particularly since large quantities of sour naphthas are being produced by modern cracking methods. Many a refinery daily converts five tons of lead sulphide back to litharge and sodium plumbite, and without this recovery the cost of doctor treating would be prohibitive. The authors emphasize the point that no recovery process is complete if anything of value goes down the sewer, and it is their purpose in this article to indicate ways in which everything of value may be recovered from spent doctor solution in the form of a pure product which may be marketed commerically, or in a form which may be consumed within the refinery. Among the products for which they give methods of separation are phenolic compounds, which will naturally vary in kind according to the kind of crude and the nature of the cracking process. Phenol and cresol will usually predominate. Many uses for these phenols can be found, as they are basic raw materials for the extensive synthetic resin industry. Another suggested use is as a

solvent in a lubricating oil purification process. Here is a chance, say the authors, of obtaining a cheap solvent costing a refinery practically nothing and one that can be had in sufficient quantity to run a solvent process. A third possibility is the use of these compounds directly (or indirectly in the form of derivatives) as anti-oxidants in the gasoline.

Other products which may and should be recovered are large quantities of sodium carbonate, which can be causticized and returned to the process, and sodium thiosulphate which can be purified and sold as "hypo", for which there is a considerable market. About the only products lost are certain quantities of sodium carbonate, sulphate and sulphite remaining in the mother liquor. The authors give three general methods of recovery and show that the cost of treatment is low, requiring simple apparatus.

Computations for Counter-Current Solvent Extraction Processes.—I. G. Hunter and A. W. Nash before Inst. Petroleum Technologists, London, December, 1935.

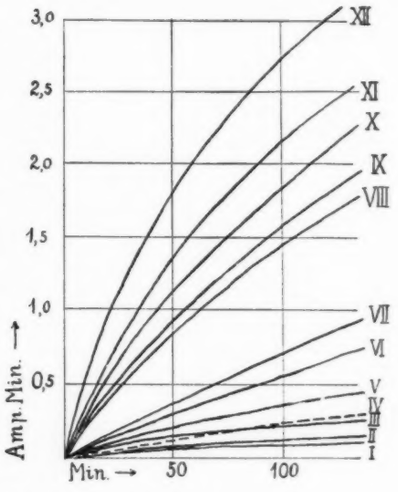
Although computations for counter-current contact processes for the extraction of a solute from a liquid by means of a second liquid have been thoroughly described in the literature, the methods for computing equilibrium relationships in a complex hydrocarbon-solvent have not heretofore been brought together in one place. The authors here describe a computation method suitable for application to the process of counter-current refining of petroleum products by means of selective solvents, using graphical representation on triangular coordinates. Given a knowledge of the value of some physical property of the oil to be treated, and the value of that physical property of the refined oil desired, it is possible to calculate the following at fixed working conditions: the yield of refined oil, the amount of solvent associated with the refined oil, the amount of extract, the amount of solvent in the extract and yield of solvent-free extract oil, the value of a physical property of the solvent-free extract oil, and the number of ideal extraction stages required to give the desired refined oil.

Copper for Sweetening Refinery and Natural Gasoline.—Walter A. Schulze and A. E. Buell, in OIL AND GAS JOUR., vol. 34 (1935), No. 22, pp. 42–46.

The term "sweetening" has been thought of by refiners for many years as practically synonymous with "doctor treating," as the plumbite method or one of its many modifications has been almost universally used as the final treatment of sour gasolines. The only other type of sweetening processes having general acceptance are based on the use of hypochlorite solutions, and these are applied mainly to natural gasoline. Recently, however, certain processes utilizing copper solutions as the sweetening media have been developed which bid fair to replace the plumbite and hypochlorite methods. The operation of several commercial units over a considerable period of time has proven so successful that many other units are now under construction.

It has been found that certain solutions of copper salts, when added to mercaptan-bearing naphthas, invariably oxidize the mercaptans to disulphides, and further investigations showed that certain copper solutions could be prepared which almost instantaneously convert cuprous mercaptides to disulphides. This was the beginning of the so-called "copper sweetening" process. The reagents used are self-regenerating (with the aid of air), and the work proceeds in such a closed cycle that the same solution has been used for more than four years.

A new modification of copper sweetening is now announced, using a "solid" reagent prepared by impregnating an absorbent, such as fuller's earth, with the copper solutions. The reagent is supported on a filter bed and the sour gasoline is contacted therewith by filtration. The only other detail is to aerate slightly the gasoline as it goes to the filter. The gasoline is sweetened so quickly that almost unbelievable flow rates are obtained. The units are therefore quite small. An installation of this kind has been used at a natural gasoline plant where much difficulty was experienced in the hypochlorite treatment of a high mercaptan sulphur gasoline. In the single item of savings of chemicals this installation paid out the investment in 35 days. No alteration in the activity of the reagent has been noted after more than six months. The cost of treatment is now down to two cents per 1,000 gallons, with prospect of further lowering if the reagent holds out.



Oxidation curves of hydrocarbons.—

I. Paraffin	VII. Naphthene alcohol II
II. Octadecane	VIII. Tetralin
III. Octadecenol	IX. Octadecane
IV. Hexadecanic acid	X. Decaline
V. Octadecene	XI. Hexalin
VI. Naphthene alcohol I	XII. Methylhexalin

Petroleum Chemistry

Reaction Kinetics of the Catalytic Oxidation of Hydrocarbons.—E. L. Lederer in PETROLEUM, vol. 31 (1935), No. 44, pp. 1–11.

It has been proposed by Evers and Schmidt to determine the aging characteristics of oils by plotting their oxidation curves and they have contrived an apparatus called an "oxidizer" for the purpose. In this paper the present author further develops the theory and practice of the matter.

The theory leads to the differential equation $dx/dt = K.(A-X)^2$, from which it results that there may be two types of oxidation curves; one that has a parabolic form, and the other the S-form characteristic of auto-catalytic processes. Evers and Schmidt have obtained both types of curves. The author's own experiments and calculations show the applicability of the equation to various types of pure hydrocarbons and organic oils. When applied to mixtures the calculations are rather complicated and uncertain. In practice it is simpler and sufficiently accurate to compare various substances by means of graphs showing the quantities of oxygen absorbed when one gram of substance is treated during a certain time at a certain temperature. The author proposes the use of "oxidator number" for characterizing oils and defines this term as follows:

The "oxidator number" is the quantity of oxygen measured in ampere-minutes (with the oxidator apparatus of Evers and Schmidt) which is taken up by one gram of substance in 100 minutes at 100° C.

In reporting such tests it is necessary to state to which of the two types of oxidation curves the substance conforms and whether the curve is rectilinear, or strongly or weakly flexed.

It is therefore necessary to make determinations at several points, say at 10-minute intervals. A good transformer oil may have an oxidator number between 0.65 and 0.85 amp.-min., with a tolerance up to 1 amp.-min. The relation between tar number and oxidator number is obtained by multiplying oxidator number by 0.0095 and by the molecular weight.

The oxidation curves of hydrocarbons mostly have the parabolic form, as shown in the annexed diagram; vegetable oils, particularly drying oils, show mostly the S-form.

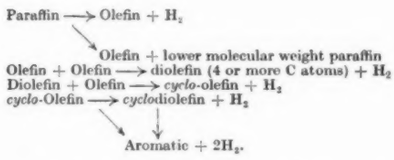
Specific Refraction and Other Physical Constants in Connection with Destruction of Mineral Oils.—H. I. Waterman and J. J. Leendertse, in JOUR. INST. PETROL. TECHNOLOGISTS, vol. 21 (1935), No. 143, pp. 816–824.

A Borneo lubricating oil fraction was separated into an extract and a refined product, each of which was subjected to a high temperature (435° C.) under high hydrogen concentration (initial pressure 100 kg. per sq. centimeter), with and without the presence of hydrogenation catalysts. From the data it is concluded that destructive hydrogenation of the refined product always caused a decrease in the average molecular weight, the extent of the decrease depending on the catalyst. The extract appeared to undergo the same destruction, but perhaps to a lesser extent. It is proved that under the conditions there is practically no change in the total amount of rings of the product. Changes in molecular weight were inferred from changes in specific refraction.

Some Thermal Reactions of Hydrocarbon Gases.—F. I. L. Lawrence, in JOUR. INST. PETROL. TECHNOLOGISTS, vol. 21 (1935), No. 143, pp. 790–816.

In this review of the literature, some thermal reactions of hydrocarbon gases, of from two to four carbon atoms inclusive, are discussed. The mechanism of the reaction forming aromatics from normally gaseous paraffins be-

tween 600° and 750° C. is discussed, and the path found to be


Paraffin → Olefin + H_2
Olefin + lower molecular weight paraffin
Olefin + Olefin → diolefin (4 or more C atoms) + H_2
Diolefin + Olefin → *cyclo*-olefin + H_2
cyclo-Olefin → *cyclo*diolefin + H_2
Aromatic + $2H_2$.

The thermal decomposition of both paraffins and olefins is considered empirically and theoretically. Rupture of the C-C bond at every conceivable place seems possible, in addition to dehydrogenation to the corresponding olefin. The formation of polymers, or miscellaneous liquid reaction products, at elevated temperatures is reviewed. Liquid yields up to 25 percent by weight have been obtained by the thermal decomposition of paraffins and up to 40 percent by weight by the pyrolysis of olefins. The practical ultimate yield that may be obtained from a gas containing 50 percent olefins and 50 percent paraffins appears to be of the order of 50 percent by weight of liquid products.

The thermal reactions of hydrogen with hydrocarbons appear to be a direct factor in lowering the ultimate yield of liquid products. Some surfaces, particularly iron, nickel, and graphitic carbon, promote the decomposition of the gaseous hydrocarbons into their elements either directly or indirectly. Some types of processes with a high liquid yield are considered.

Catalytic Air-Oxidation of a Mineral Oil in Vapor Phase.—Rudolf Klatt and Hans Jelinek in PETROLEUM, vol. 31 (1935), No. 42, pp. 1–6.

A Russian kerosene containing naphthenes was distilled in contact with air and water and a catalyzer composed of five percent of vanadic acid precipitated on pumice. The water-soluble products consisted of fatty acids, aldehydes and ketones, among which could be identified formic acid, formaldehyde, acetic acid, acetaldehyde and acetone.

Petroleum Physics

Precision of Viscosities Measured in Degrees Engler.—F. H. Garner and W. E. J. Broom in REV. PETROLIFERE, No. 649 (1935), pp. 1204–1205.

With the idea of ascertaining the degree of concordance that may be attained between two Engler viscosimeters when used in two different laboratories, and also to obtain figures that would serve to establish a precise interconversion between the results of viscosimeters used in different countries, ten oils were sent to eight laboratories in Germany, France, Holland, Denmark, and the United States.

The reports show that concordance is very poor with the Engler viscosimeter. The standard error found by statistical analysis is large. For small viscosities, of the order of 2° Engler, this error is constant at about two percent and may be positive or negative, which means that results in different laboratories may vary as much as seven percent. These results clearly show that the Engler viscosimeter, as now used, is not adapted to give reasonable precision. This is the more serious because there is no standard Engler instrument against which other instruments of the type might be calibrated. The case is different with the Redwood viscosimeter No. 1, a standard of which is kept in the National Physical Laboratory in England, and the Saybolt instrument, a standard copy of which is kept in the Bureau of Standards in Washington.

Pseudoplasticity in Mineral Oils.—H. Weiss, in OEL UND KOHLE, vol. 11 (1935), No. 41, pp. 811–815.

This investigation grew out of an observation by Erk in 1931, who found that the viscosity of certain oils at low temperatures showed different values as the temperature was raised or lowered through the same range. The phenomenon is illustrated by the behavior of a Pennsylvania Oil (Veedol V4). This sample was cooled from 20° C. to 0° C. and kept at that temperature, the viscosity being determined at intervals, with the following results.

Time of Cooling at 0° C.	Viscosity in Seconds
0	282
5 hrs.	288
1 day	293
3 days	296
10 days	311
22 days	326

The apparent viscosity evidently approaches a limit. The same oil was suddenly cooled from 20° C. to −80° C. and kept at this temperature for half an hour before allowing the temperature to rise to 0° C., at which temperature the oil was held for a number of days with periodic determinations of the viscosity. The results were:

Time of Cooling at 0° C.	Viscosity in Seconds
0	483
1 day	377
5 days	330
13 days	326

Here the same limit is approached from the opposite direction. A similar behavior was observed in Russian, Iranian, Polish and Roumanian oils, although in some instances it was necessary to work at lower temperatures (−10° C.). In other cases exactly the opposite phenomenon was observed: the viscosity fell while the oil was kept 8 days at 0° C.

It was further observed that when the viscosity pipette was filled by suction, the time of filling depends on the suction pressure, but this function is not linear, as indicated below:

Pressure, P	Apparent friction Coefficient, n
219.0 cm.	51.6 poises
105.0 "	63.8 "
63.3 "	80.4 "
37.0 "	189.5 "

It is thus not possible to speak of a real viscosity here, but rather of a pseudoplasticity that characterizes an intermediate condition between a normal liquid and a liquid which has a certain "loosening-up" pressure, which is measurable by T x p.

These phenomena are accounted for on the assumption that when an oil is cooled to a certain temperature there is a certain association or aggregation of molecules which requires time and thus involves an increasing viscosity. When cooled to a very low temperature and then warmed to a higher constant temperature, the reverse phenomena of molecular disaggregation and decreasing viscosity occur. These molecular aggregates may be broken up by shaking, but re-form on standing.

Whether a given oil will show pseudoplasticity will depend on the structure of its molecules. When paraffin crystals are dissolved in a normal oil, the oil still behaves normally, but begins to show pseudoplasticity when one percent of vaseline is added.

The practical result is that a new way is opened for the study of the composition of oils. When an oil is chosen as a standard in viscosity measurements it must be used outside the pseudoplastic range. It can also be concluded that viscosity measurements are useless if the oil is to be used under conditions that develop pseudoplasticity.

A Wide Range Boiling-Point Conversion Chart for Hydrocarbons and Petroleum Products.—E. S. L. Beale and P. Docksey, in JOUR. INST. PETROL. TECHNOLOGISTS, vol. 21 (1935), No. 144, pp. 860–870.

The experimental determination of vapor pressures of petroleum distillates and of n-dodecane down to low pressures and up to high temperatures is described.

From this and other published data a reliable boiling-point conversion chart is constructed which covers the whole range of vacuum distillation met with in the analysis of petroleum products.

The precautions taken to ensure reliability of the results, particularly at the highest temperatures, are given in some detail, to show that the data can be extrapolated with confidence in the region where accurate experiments are impossible.

A method is given for the preparation of n-dodecane, starting from n-hexyl alcohol through the corresponding bromide.

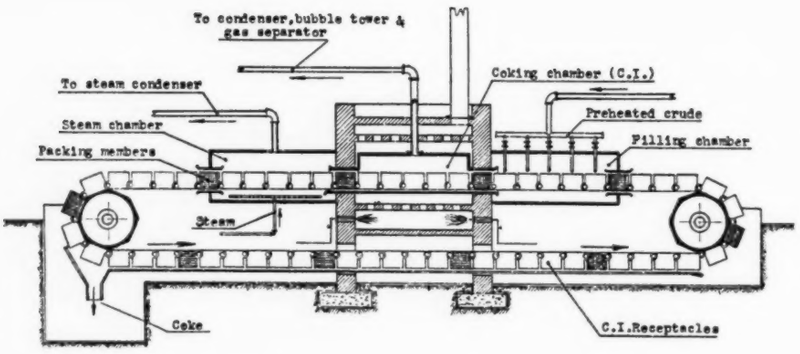
Asphalt and Tar

The So-Called Free Carbon of Coal Tar.—H. Mallison, in ASPHALT UND TEER, vol. 35 (1935), No. 48, pp. 1001–1003.

The designation of the insoluble residue of road tars as "free carbon" is objected to as misleading; it is better to call it simply "insoluble". The composition of this insoluble material is variable, but it always contains notable amounts of hydrogen. The portion insoluble in benzol is composed of tar resins and substances resembling soot. The tar resins are colloidally dissolved, high molecular compounds; different solvents dissolve different amounts of these resins, depending on the surface tension of the solvent. In this sense hot pyridine is the best solvent. When a tar residue is thoroughly extracted with hot paraffin (after previous extraction with benzol), the residue is in all respects similar to American carbon black, lamp soot and printing carbon, with a hydrogen content of slightly over two percent.

Coking of Petroleum Residues.—D. Glynn Jones, in JOUR. PETROL. INST., vol. 21 (1935), No. 144, pp. 895–906.

The present paper outlines the evolution of a



novel method of coking petroleum residues. The application of the scheme to a particular heavy residue is discussed, together with an account of the experimental work entailed. Brief descriptions are also given of some commercial coking systems.

The novelty of the method here proposed is illustrated in the accompanying drawing. An endless chain of buckets is provided for the product by which it is passed through a coking chamber connected with a condenser, a bubble tower, and a gas separator, and then through a steam chamber where the coke is cleaned of residual volatile products. The coke is discharged as the chain passes beneath the furnace. To save heat the chain of buckets is totally enclosed. The residue is discharged into the buckets directly from the Kellogg stills, entering at a temperature of approximately 350° C., filling of the chambers taking place in an atmosphere of steam.

Adhesion of Tar and Bitumen to Road Materials.—P. Herrmann in ASPHALT UND TEER, vol. 35 (1935), No. 44, pp. 905–908.

Various German investigators have carried out extensive experiments in the study of the adhesion of bitumens and tars to all sorts of materials used in road construction, the object being to work out testing methods for use in drawing up specifications. All this study and investigation, however, has led to no practical result. The actual adhesion between the clean stone and the clean binding material is of very little practical importance. Aside from the roughness and porosity of the stone, the binding power of the tar is determined by three main factors: (1) The moisture on the stone; (2) The insulating layer of dust on the stone; (3) The presence, in the tar or on the stone, of substances capable of swelling in water. Only when these three factors are excluded is it worth while to study the actual contact between stone and binder; but as it is impossible to exclude them, studies of the kind indicated have no practical significance.

Oil Uses

Lubrication of Watches.—P. Ditisheim, in REV. PETROLIFERE, No. 652 (1935), p. 1315.

This study relates to the lubrication of apparatus functioning at low temperatures. The best lubricants for time pieces are mixtures of fatty oils and mineral oils, which are given a special treatment with anti-oxidants to circumvent decomposition. But it is also possible to select mineral oils alone that will stand the great cold of high altitudes without congealing. This use has been made possible by discovery of the Epilame process, based on a study of the properties of molecules. Certain of these oils preserve the necessary fluidity even down to temperatures as low as −75° C. The author discusses the results obtained with these special lubricants.

Petroleum Derivatives in the Paint and Varnish Industries.—C. C. Gray in PETROL. TIMES, vol. 34 (1935), Nos. 866 and 867.

Among the products resulting from direct distillation of petroleum that are used as such in paints, the asphalts or bitumens are of chief importance. The decisive properties are color, softening point (which should be high), and penetration (which should be weak). Certain crude bituminous petroleums, when carefully distilled, give a clear brown asphalt which is much desired for painting. Certain gasolines having narrow boiling ranges, for example between 150° and 200° C., are used as thinners or diluents. Certain of these derivatives can be used for diluting varnishes with a cellulose base; this is especially true of certain Borneo products which are displacing coal tar products such as benzol, totual and xylol.

The naphthenic acids are finding interesting applications in paints and varnishes. By esterification they yield materials for plastics. Their alkali soaps find employment as emulsifiers. Their principal use, however, is in the form of metallic naphthenates as siccatives (dryers) and as insecticides. The naphthenates of cobalt, manganese and lead are especially useful. Many secondary petroleum derivatives, as alcohols, glycols, etc. find use as paint removers. The use of carbon black as a pigment is, of course, well known.

Heats of Vaporization of Eight Gasolines.—Ralph S. Jessup, in BUREAU STANDARDS JOUR. RESEARCH, vol. 15 (1935), No. 3, pp. 227–236.

Measurements of the heats of vaporization at 40° C. of eight gasolines were made. The fuels investigated included one natural gasoline, two aviation gasolines, one straight run naphtha, three cracked naphthas, and one "safety fuel." The last named fuel is a hydrogenation product, which is apparently richer in hydrocarbons of the aromatic series than the other fuels. The results on all the fuels, except the safety fuel, can be represented by a linear function of either specific gravity or average volatility.

The application of the results to the problem of ice formation in the carburetors of aviation engines, due to cooling produced by evaporation of the fuel, is briefly discussed. It is concluded that large differences in the rates of formation of ice with different fuels cannot be attributed to differences in the heats of vaporization, but must be largely due to differences in the completeness of vaporization of the fuels in the carburetor, resulting from differences in volatility of the fuels. The more volatile a fuel the more completely it will be vaporized in the carburetor under given conditions, and the greater will be the heat absorbed per pound of fuel. For example, according to Allen, Rodgers, and Brooks, with an air-fuel ratio of 12, a fuel having an average volatility of 87° C. will be 78 percent evaporated in the carburetor at 0° C., while a fuel having an average volatility of 101° C. will be only 55 percent evaporated at 0° C. Hence, assuming that the two fuels have about the same heat of vaporization, the more volatile fuel will absorb 42 percent more heat per pound than the less volatile one.

Gasoline and Oil Problems in Transpacific Flying.—John C. Leslie, before Soc. Automotive Engineers, San Francisco (1935).

The major problem of transoceanic flight is one of burning fewer pounds of gasoline per horsepower hour; the smaller the weight of fuel that has to be carried the greater the possible pay load. At present such long-distance aircraft as the China Clipper are operating with a specific consumption of 0.48; if this could be reduced to 0.42 pay load could be increased 12½ percent. This is mainly a problem of engine design, but there is also required a gasoline of high octane rating. Uniformity in color and gum stability are extremely important, both practically and psychologically, as flying men are more apprehensive of unfamiliar appearances than any other users of gasoline. As regards oil, it is highly desirable to make a transpacific flight without refilling, and this puts on the oil manufacturers the burden of supplying a lubricating oil that will allow an engine to operate between 50 and 60 hours without sludging.

Complications in the Use of Extreme Pressure Lubricants.—A. L. Foster in NAT. PETROL. NEWS, vol. 27 (1935), No. 50, pp. 50–51.

Some oil companies have given extreme pressure characteristics to all gear lubricants marketed through their stations. Due to the fact that different oil companies use different formulas in compounding their extreme pressure lubricants, a situation has arisen that demands care on the part of car owners and filling station men.

The difficulty may arise because of the reactions which may take place between the non-mineral oil compounds used to impart E. P. properties to the lubricant. To illustrate the possibilities, most E. P. lubricants contain one or more of the following elements, in one combination or another: lead, sodium, aluminum, chlorine, sulfur. In addition, other materials which may possibly be used are castor oil, saponifiable oil such as lard oil, and glycerine.

Lead, one of the commonest metals in such lubricants, reacts, or may react under the

proper conditions, with either chlorine or sulfur, forming the insoluble sulfide or chloride of lead. If formed, these salts are insoluble in water, and probably so in the oil of the lubricant. Therefore the salt will precipitate or be thrown out as a solid, which certainly is no part of a lubricant, E. P. or otherwise. The salt doubtless will be suspended for a time in the liquid portion of the lubricant, gradually precipitating out on gears and container walls, such as the gear box or housing.

Two conditions may be the results of this reaction. The first is that a product is formed which is not a lubricant, and which may have no E. P. properties whatever. Second, the removal of the E. P. materials from the lubricant by combination with another material present in the other lubricant lessens the amount of active E. P. material available for the job of lubricating the hypoid or other gear, lessening the efficiency of the remaining lubricant, and inviting disaster as result of insufficient lubrication to carry the load.

Petroleum Substitutes

New Fuel for Ship Drive.—Anon., in PETROLEUM, vol. 31 (1935), (Beilage VIII, 12).

The "gasogene," which consists of a generator in which solid fuel (wood, etc.) is gasified by heat and the combustible gas used for driving automotive vehicles, has now been extended to water transportation in Germany. This article describes such a gasogene installed in a tug boat. The apparatus consists of a sort of blast furnace; cheap solid fuel (anthracite fines, coke breeze), is burned on the grate, below which steam is injected. The outfit is, in effect, a plant for the production of water gas having a heat value of 1,100 to 1,300 Kcal/cub. meter. After purification the gas is used in a Deutz 8-cylinder 4-cycle engine which can be adjusted for gas or Diesel operation, as desired. Under existing circumstances in the German oil and coal markets, the power cost of a ship of 750 h.p. is only half the cost of Diesel operation when use is made of coke breeze. The necessary steam for the generator is raised by the heat absorbed by the cooling water.

Development of Hydrogenation by the I. C. I.—Kenneth Gordon, in PETROLEUM TIMES (London), vol. 34 (1935), No. 880, pp. 547–558.

In this paper the technical and scientific aspects of the operation of the coal hydrogenation plant at Billingham, England, are studied in considerable detail. Difficulties encountered in the development of the process are graphically described. Diagrams showing the production and separation of intermediate and final products are given.

Synthetic Gasoline in Germany.—Oskar Tokayer in PETROLEUM PRESS SERVICE, vol. 2 (1935), No. 2, pp. 5–6.

Of the two processes for making synthetic gasoline that have reached the industrial stage in Germany—the Bergius I.-G. and the Fischer-Tropsch processes—it now appears that the Fischer-Tropsch process will achieve the greater importance, due to its requiring less costly apparatus. The following figures relate to plants that are now operating, under construction or projected, grouped according to the processes used and raw materials to be treated:

	Annual capacity in tons
1. *Bergius-I.-G. Farben (Hydrogenation) process*	
(a) Lignite basis	
(1) Leuna plant	300,000–330,000
(2) Braunkohle-Benzin A.-G. Doehlen plant	150,000
Magdeburg plant	150,000
(b) Bituminous coal basis	
(1) I.-G. Farben, Ludwigshafen-Oppau	60,000– 70,000
(2) Hydrierwerke Scholven A.-G. (Bergwerksgesellschaft Hibernia)	125,000
2. *Fischer-Tropsch process* (Hydrogenation of gas)	
(a) Lignite basis	
(1) Braunkohle-Benzin A.-G.	25,000– 30,000
(b) Bituminous coal basis	
(1) Gewerkschaft Viktor, Castrop-Rauxel (Klöcknerwerke-Wintershall A.-G.)	25,000– 30,000
(2) Ruhr-Benzin A.-G. (Ruhr-Chemie A.-G.)	25,000– 30,000
(3) Gewerkschaft "Rheinpreussen" (Haniel group)	25,000– 30,000
Total tons	885,000–945,000

If all the plants projected as well as those which are under construction are carried out, Germany will then produce its own motor fuel requirements from coal to the extent of about 900,000 tons annually. But it is impossible for practical reasons for this to be achieved by the middle of next year, as has been envisaged. The completion of only one Fischer plant is projected for 1936. Experience has shown that a lengthy period is likely to elapse before the plant comes into full operation.

So far as the economic side of the manufacture of synthetic gasoline in Germany is concerned, it would appear that though the Fischer process is much cheaper than the I.-G. process, the cost of petrol manufactured by these means will be very substantially higher than the cost of imported petrol. That this point of view is being realized even in Germany is clear from some remarks in the last monthly report of the Deutsche Bank and Disconto-Gesellschaft, which points out that the supplying of Germany from home sources with all the motor fuel required would involve the provision of capital on such a scale that it could in no circumstances be furnished from private sources and that, further, a very high level of prices would have to be maintained because of the great financial risks involved in the development of the processes utilized.

Petroleum Economics

Profits of U. S. Oil Industry.—Oskar Tokayer, in PETROLEUM PRESS SERVICE, vol. 2 (1935), No. 22, p. 3.

Net profits of sixteen companies which have announced their results amount to $27,437,383 for the third quarter of 1935 against $21,416,000 in 1934, an increase of 28 percent; while the total for the nine months has risen from $47,561,472 to $60,724,885 or 27.5 percent. The following table shows how these figures are arrived at:

	Third Quarter 1935	Third Quarter 1934
Amerada Corporation	$ 441,600	$ 424,657
Associated Oil Co.	642,475	691,619
Atlantic Refining Co.	1,625,000	2,384,700
Continental Oil	2,435,000	2,055,282
Mid-Continent Petroleum	945,552	380,075
Ohio Oil Co. (a)	997,000	793,400
Phillips Petroleum	4,830,000	1,698,549
Plymouth Oil Co.	205,394	151,959
Seaboard Oil	373,000	328,703
Shell Union Oil (b)	3,882,915	1,488,704
Standard Oil of California	5,176,000	5,916,000
Standard Oil of Kansas	24,347	76,868
Texas Gulf Producing Co.	239,100	209,200
Tide Water Associated	2,462,000	1,904,284
Tide Water Oil Co. (b)	2,108,000	1,512,000
Union Oil of California	1,050,000	1,400,000
	$27,437,383	$21,416,000

(a) After allowing for preferred dividend requirements.

(b) Before allowing for preferred dividend requirements.

Results in individual cases vary according to the character and sphere of activity of the particular company. Companies operating in California, e.g., Standard Oil of California, Associated Oil Co., and Union Oil, show smaller earnings in the third quarter of this year than in the similar period of last year, owing to the reduced prices for crude oil and finished products, although in all these cases the nine months results show an improvement. In the case of the Shell Union, results for both periods are more favorable, although that company has important operations in California. Its better showing is explained by improved results in other parts of the United States and also partly by the fact that in California the company not only produces but purchases a certain amount of its crude oil requirements, and could thus to some extent take advantage of the lower crude prices in that State.

The setback in the profits of the Atlantic Refining Company is attributed by the Company to unprecedented losses in overseas business and to lower prices in the domestic market. The third quarter's results ($1,625,000, compared to $2,384,700 in 1934) show a great improvement in the first and second quarters this year, as the company during January-June, 1935, reported a net profit of only $255,378. In contrast may be mentioned the large increase in earnings shown by the Phillips Petroleum Company, which, apart from the general improvement in prices and increased sales, is principally due to the increase in the prices of natural gasoline, of which the company produces large quantities.

Prospects of Russian Oil Exports.—Oskar Tokayer, in PETROL. PRESS SERVICE, vol. 2 (1935), No. 21, pp. 1–2.

Until recently Russian domestic requirements consisted mainly of kerosene and fuel oil, the first as the illuminant used by the great masses of the people, the second as the principal combustible on the railways. Their consumption was drastically limited when, for reasons associated with export or monetary policy, it was decided to maintain or to increase the quantities sent abroad. Home necessities then had to give way to export requirements. Kerosene and fuel oil continue to be the main

items of home consumption, and if the demand for them were fully met there would remain very little for export purposes. As against these products, light and heavy fuels for motor vehicles, tractors and aircraft have been continuously growing in importance. A diminution of requirements for these purposes is scarcely possible; otherwise the efforts so strenuously made towards technical progress would be illusory. There can be no question of forcing the production of larger numbers of motor vehicles if there is not sufficient gasoline to operate them; and for the same reason the manufacture of new tractors is purposeless unless suitable fuel is provided for them. It cannot yet be known to what extent the Soviets are ready to abandon their policy of adjusting inland consumption in accordance with the production and export position; but it is obvious that the more the nation progresses, the larger must be the inroads upon the total production for vital and irreducible needs. If in former years Russian oil policy was pivoted upon exports, to which home demands had to be subordinated, inland consumption is now the deciding factor and is growing in importance every day. Only after satisfying that portion of the demand which is regarded as indispensable can the Soviet Government liberate any oil products for export.

This profound change in Russia internal economy is the key to the steady decline of the Russian oil export trade. Production has not kept pace with demand; nor is the refining industry sufficiently up-to-date to make up the deficiency by obtaining larger proportions of light products from a given quantity of crude; hence the fall in exports was inevitable.

General

Gasoline from Acetylene.—B. Kwal, in ACTUALITE CHIM. IND., vol. 34 (1935), No. 4, pp. 773–776.

Experiments were made to transform acetylene into liquid hydrocarbons under various conditions. The most suitable catalyzer for this operation is a mixture of active carbon and cuprous oxide. The best results are obtained when, during the course of the condensation of acetylene, hydrogen is introduced so that it may combine with free carbon. By this introduction of hydrogen it is possible to avoid, on the one hand, any separation of elementary carbon, and on the other hand to increase the yield of gasoline. The quality of the gasoline thus obtained is excellent, and it seems possible to base a practical process on the chemical principles involved. The reaction takes place under a maximum pressure of 25 atmospheres. The residual gas contains four percent of ethylene, seven percent of ethane and six percent of hydrogen. The liquid products (end b.p. 160° C.) is about 70 percent, calculated on acetylene. No precipitated free carbon or polymerization products accumulate in the catalyzer chamber.

Fundamental Characteristics of Alloy Steel.—E. S. Davenport, before Am. Petrol. Inst., Los Angeles, Nov. 1935.

In common with most of our basic industries, the petroleum industry is a large consumer of steel; perhaps, on a tonnage basis, next in importance only to the automobile and railroad industries. Steel is, without doubt, the industry's most important structural material, and there is no phase of the vast and manifold activities involved in petroleum technology in which ferrous alloys in one form or another do not play a vital part. The elements of the metallurgy of alloy steels are here discussed briefly, in as simple terms as possible. Technical terms are defined in the text, and heat-treating terms are defined in an appendix. The author believes that there are a small number of fairly simple basic principles which determine the behavior and properties of any steel, and that a proper grasp of these principles is necessary if steels are to be selected and used intelligently over the very wide range of conditions of actual service. The most important of these principles are outlined and illustrated; few specific applications are mentioned, although it is hoped that the discussion will be found applicable to some of the current metallurgical problems of the industry.

The Bases of Crude Petroleums.—E. C. Lane and E. L. Garton, in BUR. MINES, RPT. OF INVESTIGATIONS, No. 3279 (1935).

From hundreds of analyses of crude petroleums made at the Bureau of Mines, the authors have developed a system for the classification of the bases of these oils. When first published, in 1927, the system comprised only four classes. This number has proved insufficient, due to the discovery of new types of crudes in various parts of the earth. There are now seven "bases," the first being paraffinic and the last naphthenic; the others being described according to whether the base consists mostly of paraffin or naphthene, the middle classification comprising those crudes in which the two basic substances are in about equal proportions. The present publication gives a typical analysis of each type.

Relation Between Anti-Knock Values of Fuels and Motors.—Maximilian Marder in OEL UND KOHLE, vol. 11 (1935), No. 47, pp. 923–928.

The octane number of a motor fuel, which is generally regarded as a measure of the anti-knock value of the fuel, varies according to the conditions of the test and the construction of the test engine. The variations of one and the same fuel under varying conditions may extend over a range of 25 octane numbers. The standard test is laid down in very specific terms by the A.S.T.M. method D 357–34T, using the test engine developed by the Co-operative Fuel Research Committee of the A.P.I. But the octane number thus determined loses much, if not all, of its significance when the fuel is used in another engine under different operating conditions. If the octane number of a fuel is to have any real significance it must be determined in the engine in which it is to be used, i.e., there must be as many test engines as there are engine types, and even then the figure will be valid only for a certain definite condition of operation, although a curve showing variations could be worked out for the fuel under different conditions.

The chief real clue to the anti-knock value of a motor fuel lies in its chemical composition. The chemical composition of a petroleum product finds outward expression in its physical properties. Chief among these for the purposes here considered is the parachor, which contains an indication of the presence of the side chains, rings, and double bonds that are of importance in determining the anti-knock property. (The parachor of an oil is given by the expression $p=\frac{\sigma^{1/4}}{d}$, in which σ is the surface tension and d the density).

It has been shown that in some cases there is an exact, in others a close agreement between the physical properties of a fuel and its anti-knock value. For this determination it is sufficient to know the "boiling-characteristic" of the oil (determined according to Ostwald) and the parachor or density of the fuel. Between the density of fuels of the same "boiling characteristic" and their octane numbers there is a linear relation. On this basis it is possible to construct a calibration curve that will show the performance of a given fuel in a given engine under any operating condition.

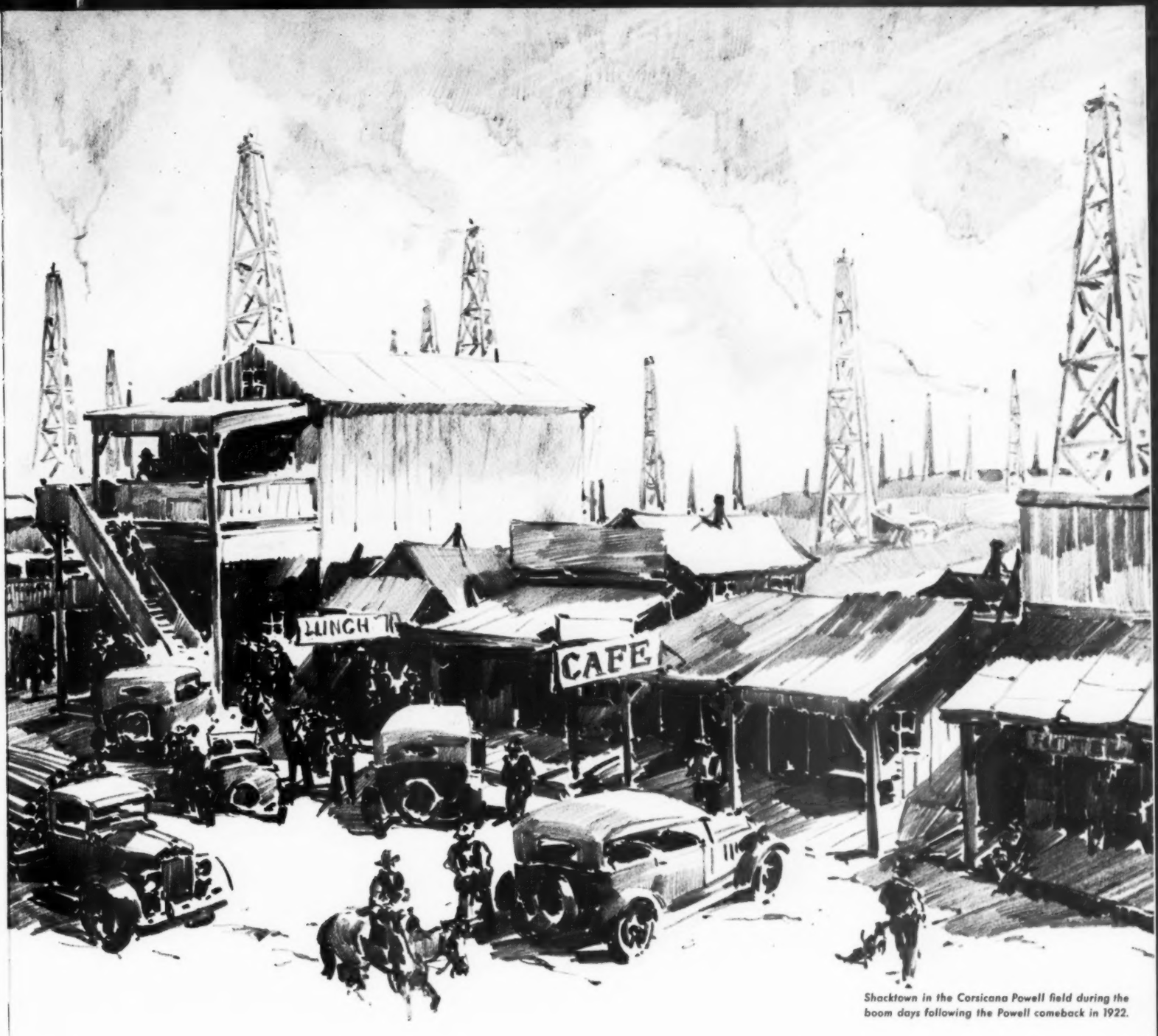
Preservation of Oil Products.—Anon., CHEMICAL TRADE JOURNAL, vol. 97 (1935), pp. 25; 49; 69; 113; 115.

This is a long and interesting summary of the action and use of stabilizers, inhibitors or anti-oxidants in connection with stored petroleum products of various characters and origin. Many well known photographic developers make good inhibitors, especially the amino phenols, among which the *para*-derivatives are the most active; the most useful appears to be para-benzyl amino phenol, which is soluble to the extent of 0.2 percent in cracked gasoline. Pyrogallol and hydroquinone are excellent inhibitors but their solubility in water is a disadvantage. Alphanaphthol is also recommended for cracked gasoline, tri-cresol for products of the high temperature distillation of coal, para-methyl amino phenol and p-benzyl amino phenol for low temperature gasolines. Some dye stuffs used for coloring gasolines are also useful inhibitors in as small proportion as one part in 10,000 to 20,000 parts; these dyes include indophenols (blues and reds), oxazines and indamines (greens and blues), eurhodines and suframines (reds); these dyes may be used in connection with a colorless inhibitor to prevent fading. Dyes with azo and nitro groups adversely affect inhibitor activity. Sulphur and most sulphur compounds, such as mercaptans, are accelerators of oxidation.

Discordant results have been reported by various investigators using the same inhibitor. These discrepancies are perhaps due to the presence of natural inhibitors or accelerators in the gasoline. Sometimes an unrefined cracked gasoline may be used as an inhibitor. Minute traces of acid products have been known to have a pronounced effect in stimulating resinification and gum formation.

The use of inhibitors has been extended to other petroleum products besides gasoline. A hydroxy diphenyl in amounts less than 0.5 percent has been proposed for stabilizing cylinder oils, transformer oils and mineral greases; ethylene diphenyl diamine has been proposed for engine oils. Tin naphthenate has been found particularly effective as a stabilizer of transformer oils; organic acid salts and compounds of lead and tin are used for non-sludging oils. Certain hydrocarbons containing sulphur, selenium or tellurium have been proposed for solvent-refined lubricating oils.

These are only a few of the many angles of the uses of inhibitors presented in the paper.



Shacktown in the Corsicana Powell field during the boom days following the Powell comeback in 1922.

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Official Figures for Soviet Oil Operations

1935	Crude Production (bbl.)	Daily Average (bbl.)	Run to Stills (bbl.)	Drilling (feet)
January	13,356,000	430,840	11,403,700	247,932
February	12,709,900	453,900	8,109,500	334,986
March	14,140,700	456,151	11,714,500	449,700
April	14,092,400	469,747	12,052,600	442,833
May	15,248,800	491,900	11,816,000	421,225
June	14,232,400	474,410	12,312,300	374,028
July	14,777,000	476,680	12,198,500	423,073
August	15,091,300	486,816	13,240,500	393,426
September	14,849,100	494,970	12,518,100	417,890
October	16,040,500	517,435	13,469,400	463,032
November	16,050,000	535,000	13,420,000	450,100
December	16,100,000	519,355	13,450,000	450,250
Total 1935	176,688,100	497,713	146,705,100	4,868,465
Total 1934	168,846,000	458,042	145,141,000	4,122,898
Quota 1935 (Revised)	212,310,000	581,672	171,500,000	5,214,000
Quota 1934	214,900,000	588,876	161,000,000	4,950,000

Crude conversion: seven bbl. = one ton

CONSIDERABLE progress was made by the Soviet oil industry during the last three months of 1935 and the total showings of all three major divisions represent record figures for all times. Baku properties took the lead in improved production, followed by Maikop, Emba and Bashkirneft (Ishimbayevo). No material improvements were reported from Grozni.

The daily average crude production of all Baku oil fields in December reached 392,000 bbl., and on individual days 408,000–415,000 bbl. (Plan requirements for Baku are 422,000 bbl. per day.) Daily average for all other Soviet oil fields in December amounted to about 127,000 bbl. per day, as against 157,000 bbl. per day required by the quota.

Total Soviet Crude Production by Quarters 1935

	Crude Production bbl.	Runs to Stills bbl.
Jan.-March	40,206,600	31,227,700
Apr.-June	43,573,600	36,180,900
July-Sept.	44,717,400	38,957,100
Oct.-Dec.	48,190,500	40,339,400

The ratio of crude runs to stills to production during 1935 was 82.0 percent, as against 86 percent in 1934 and 81.0 percent planned for 1936.

Soviet Production by Fields During 1935
(Figures in bbl.)

Baku	136,432,800
Grozni	23,313,500
Maikop	8,335,600
Emba	1,708,000
Bashkiria	2,841,300
Sakhalin	1,652,000
All others	2,404,000
Total	176,688,100

The ratio of production of the individual fields to the total 1935 Soviet production was as follows: Baku 77.2 percent (plan—54 percent), Grozni 13.1 percent (plan—35 percent), Maikop 4.1 percent; or 94.4 percent in the Caucasus and 5.6 percent outside of the Caucasus, of which the Ural field of Ishimbayevo contributed 1.6 percent of the grand total. In 1932 the Caucasian fields contributed 97.5 percent and the fields outside 2.5 percent. In 1933 the proportion for all Soviet oil fields outside the Caucasus amounted to 2.9 percent and during 1934, 2.6 percent.

The 1935 increase in production over 1934 equals about 8,000,000 bbl. of crude. The total, however, fell short of the plan about 35,000,000 bbl. Likewise, in runs to stills the increase over 1934 amounted to 1,500,000 bbl., but fell short of the plan about 25,000,000 bbl. Other Soviet branches of Heavy Industries have shown considerable gains over 1934 operations.

Of all the accomplishments of the Soviet oil industry during 1935 the following are most noteworthy.

Production: The Soviets have managed to master the technique of drilling inclined wells and have attained drilling speeds of 970 ft. per outfit per month at Baku, 1,042 ft. per outfit per month at Grozni, 1,376 ft. per outfit per month at Maikop, while the average of all Soviet fields was 960 ft. per outfit per month. In the United States, drilling speeds range between 1,980–2,300 ft. per rig per month. At the same time, however, other phases of Soviet operation still leave much to be desired, as the accompanying table comparing Soviet and American operation clearly indicates.

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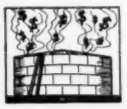

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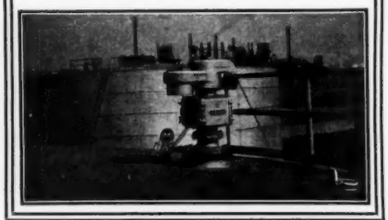

Efficiency of Soviet Operation vs. American

	U.S.S.R.	United States
Percent time lost due to breakdowns, etc.	31.7	2.5
Percent time required for lifting drilling equipment	43.7	18–20
Percent time utilized for drilling	24.6	75–80

Refining: The Winkler Koch type cracking furnace which was adopted by the Soviets for all cracking units in U.S.S.R. has been modernized. It now consists of two furnace systems and the installation can be operated on all kinds of input, yielding 30 to 55 percent gasoline from the crude potential.

Refinery Erections: Two pipe stills of 21,000 bbl. per day capacity were completed at Baku (Piatakoff group of plants) and two similar ones completed at Grozni. These are of Soviet design and construction, and will produce gasoline, kerosene and ligroin. Another unit is under construction at Ufa. Two cracking units were erected at Baku and two cracking units for the secondary rerun from the manufacture of cracked gasoline (6,000 bbl. capacity per day) were completed at Grozni. At Saratoff all eight cracking units are on stream and preliminary steps have been taken for the erection of pipe stills. Two cracking units have been completed at Gorki. A pipe still of American design and construction, having 3,500,000 bbl. yearly capacity, has been ordered for refining Ishimbayevo crude at Ufa. This refinery will yield 54 percent motor fuel from the crude potential and will be the first Soviet refinery to yield such a high rate of gasoline. All other Soviet refineries yield from 25 to 30 percent. The American manufacturers have put all working drawings at the disposal of the Soviets, which will assist the domestic engineering organizations in designing all future projects.

Pipeline Construction: The Caspiorsk pipeline (from Guryeff on the Caspian Sea to Orsk) has been completed and first shipments of Emba oil were made in December. This pipeline, which was started in 1931, has a total length of 847 kilometers (526 miles) including the branch line to Koschagil. The line consists of 12 in. pipe electrically welded and has six pumping stations operated by Diesel engines. The total capacity is 17,000,000 bbl. of crude per year. A water supply main is being laid along the pipeline and a railroad is under construction from Guryeff over Aktiubinsk to Orenburg. This railroad will connect the Emba oil fields with the network of all other Soviet railroads and open the flow of Emba oil to the Eastern provinces of the country, particularly to Siberia which is being rapidly industrialized. This railroad will also help to further the development of Emba oil fields. A total of about 1,000 to 1,200 salt dome formations are reported at Emba, of which only about 300 have been studied, and of these only 15 or 17 have been tapped for oil resources.

Another pipeline has been completed from Grozni to Makhatch Kala, which is an oil wharf on the Caspian sea. This is a 10 in. line and extends over a distance of about 160 kilometers (99 miles). It has a capacity of about 11,000,000 bbl. of crude per year and was completed in eight months. This line will serve to facili-

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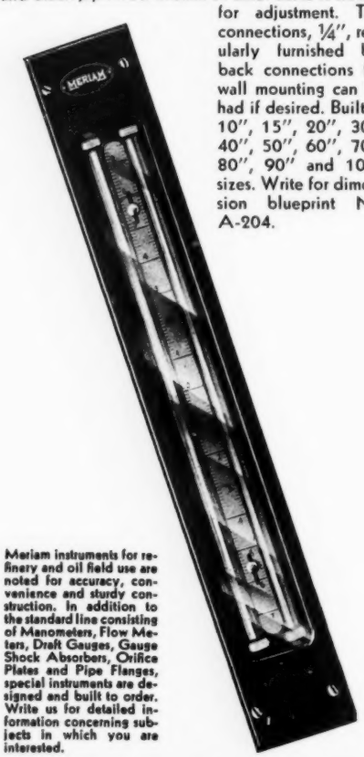

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tate the shipment of Baku crude for processing at Grozni and relieve conditions which now necessitate shipping Grozni oil products by rail to Makhatch Kala, for further distribution by tankers on the Caspian Sea to Astrakhan and elsewhere. Pipeline transportation is about 50 percent cheaper than rail transportation and, in addition, it relieves the Caucasian railroads of the burden of carrying oil shipments. During December the first 500,000 bbl. of oil were shipped by this pipeline.

J. WEGRIN

▼

Peruvial Oil, 1934

FINAL official statistics for the year 1934 show that the total production of oil in Peru during that year was 16,314,381 bbl. of crude. This is an all-time record, being 3,057,063 bbl. over 1933. The production of natural gasoline also established a record, amounting to 1,221,004 bbl., an increase of 152,260 bbl. over 1933.

Exportation of crude oil in 1933 was 1,351,312 bbl., most of it being shipped from the port of Talara. There were also exported 389,359 tons of gasoline, 124,677 tons fuel oil, 38,743 tons kerosene, 71,248 tons gas oil and 1,037 tons lubricating oil.

▼

Record British Imports

DECEMBER imports of petroleum and products in Great Britain maintained the general average for the year and resulted in a new all-time high record for quantity imported into England for 1935. Among the various products, the year's record may be said to be due entirely to increased imports of crude and gasoline. Smaller imports from Iran were entirely offset by larger imports from Iraq. The United States, Dutch West Indies and Iran accounted for the increased shipments of gasoline. Imports of kerosene were characterized by decreased shipments from the United States.

British Oil Imports by Products

	December 1935	12 months to December 31, 1935	12 months to December 31, 1934
Lamp oil	642,228	5,468,597	6,345,485
Motor spirit	2,545,461	35,341,034	32,204,343
Lubricating oil	305,114	2,871,401	2,955,570
Gas oil	354,054	3,107,139	3,823,374
Fuel oil	1,640,654	18,830,312	19,062,914
Other sorts	45,060	475,830	584,771
Total products	5,532,571	65,618,483	64,976,457
Crude	966,288	14,271,260	13,628,371
Total Imports	6,498,859	80,365,573	78,604,828

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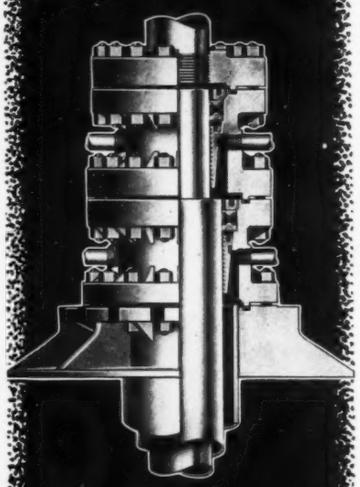

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